THE TELEGRAPHIC JOURNAL AND

Electrical Review.

VOL. XVII.—No. 405.

ELECTRICAL RAILWAY APPLIANCES.

EACH succeeding railway accident as it occurs inspires hope in the breast of many an anxious inventor, for the latter sees that the appliances for ensuring safety in railway travelling, excellent as they are, are yet by no means perfect. The hand-worked system of block signalling controlled by the action of the outdoor signals and points themselves, will probably never give way to a purely automatic system, and it does not seem advisable that it should do so; the very fact that a signalman has to manipulate a portion of the apparatus by hand, practically ensures a continual supervision of the whole installation, whereas if the whole working were purely automatic the apparatus would after a time be left entirely to itself until some failure, which a constant supervision (as in the case of the semi-automatic system referred to) would have detected, produced disastrous results.

The indication of the position of the signal arm of important distant signals by electrical means is now the rule rather than the exception, but the method adopted in many cases of effecting the object in view is, we think, open to very grave objection. The contact apparatus ought certainly to be worked direct off from the signal arm, and not, as we believe is often the case, from off the signal rod; a failure of the latter above the point at which the contact apparatus is fixed (and such failures have taken place) might be a very serious matter, though hitherto, we believe, no accident has resulted from this cause. The means of indicating the position of junction points by electrical means are well known, though they have been very sparingly adopted. The recent accident at Earl's Court may draw attention to the increased necessity of applying such apparatus at important points, the contact apparatus being, of course, placed so as to work direct from the signal arm or points themselves, and not from any bar which may be connected through the medium of a joint.

ELECTRIC LIGHTING OF A BRAZILIAN IRONCLAD.

A VERY complete installation of the electric light has, as we briefly stated last week, been carried out by Messrs. R. E. Crompton & Co. on the new ironclad constructed by Messrs. Samuda Bros., of Poplar, for the Brazilian Government. This vessel, the *Aquidaban*, which is now lying in Milwall Docks, is the second Brazilian ironclad so furnished, the *Riachuelo* having been lighted by Messrs. Siemens last year.

The electric light machinery on board the *Aquidaban* consists of three distinct sets of dynamos and engines, each being capable of supplying current for 180 incandescent lights, or for both of the large search lights, which form an important part of the installation. The dynamos are of the newest type of Crompton's machine, with an E.M.F. of 80 volts at the terminals. These are coupled direct with compound Willans engines, which have 5-inch cylinders for high and 9-inch for low pressure, with a 6-inch stroke, working at a speed of 350 revolutions per minute, and with 70 lbs. of steam.

A great feature in the dynamos is the large mass of pure, soft wrought iron in the field magnets, which enables a very intense magnetic field to be produced, and the requisite E.M.F. to be obtained with a very slow rotation of the armature, the vibration and noise of the moving machinery being in consequence reduced to a minimum.

Swan lamps of 16 C.P. nominal, working at from 18 to 20 C.P., are employed, to the total number of 220. These require an E.M.F. of 80 volts and $\frac{7}{8}$ ampère current. The character of the vessel has necessitated unusual precautions for the protection of the lamps, and the fittings are therefore provided with springs, which lessen the liability to fracture from the concussion caused by the firing of the heavy guns in the turret. The compact manner in which the machinery employed in propelling the vessel is arranged, and the magnitude of this important portion of the ironclad, have left but little room for the electric light fittings in many necessary parts, and have given occasion for the exercise of considerable ingenuity in conducting the leading wires and placing the lamps. These difficulties have, however, been successfully overcome by the contractors, and every portion of the ship is lighted in a satisfactory manner. There are in essential positions several lamps constructed so as to allow of their being taken in the hand and carried for some distance, a considerable length of cable being coiled round each. These are for convenience in examining certain parts so placed as to be difficult to light by a stationary lamp; and for other obvious purposes.

There are two projectors on board, one placed aft, the other in an elevated position, on a conning tower in front of the bridge. These are of necessity constructed in a most substantial manner, as they are fully exposed to wind and wave, to withstand which in rough weather fixtures of no ordinary strength are required. The light which these projectors are capable of giving is said to be of 25,000 C.P. The mirrors are held by a spring suspension arrangement, newly invented by Mr. Crompton, which conduces to their greater safety when the guns are fired.

The fittings, including the projectors, lamps, switchboards, &c., have all been made and designed specially for the particular work in which they are employed.

The double wire system is followed, the leads being preserved by means of wood cases carefully made of the best teak, which are so arranged, by the filling in of all interstices, that they are absolutely water-tight. A separate groove is given throughout for each wire. The cables are, some of the London Electric Company's manufacture, and others those of Messrs. Johnson & Phillips.

The work has been carried out under the supervision, on behalf of the Brazilian Government, of Mr. Farquharson.

ELECTRIC LIGHTING OF IRONWORKS.

A fortnight ago we alluded to the electric lighting station being built at the works of Messrs. Marshall, Sons & Co., at Gainsborough, which contains foundations for eight engines. *Engineering* states that at present only two of these are fixed, one to drive the boiler shop and the other a large Crompton dynamo, capable of utilising from 50 to 60 horse-power.

The system adopted is to run the lamps in parallels of five in series, by means of a compound-wound dynamo, and in this method the electromotive force is sufficiently low to avoid all personal danger, and at the

same time a reasonable economy is secured in the main leads. As at present erected the current at first passes to the main switch-board, which is made of enamelled slate, and contains six switches for the positive wires, also six Hedges's cut-outs, and six switches for the negative wires, the latter of which are only used when it is desirable to insulate the circuit. At present there are only four circuits, three of which run to the erecting shop, and are composed of naked copper wire attached to insulators and carried over the tops of buildings after the manner of telegraph wires. The distance from the dynamo house to the erecting shop is about 400 feet, and the erecting shop itself is about 260 feet by 230 feet.

There is a distributing switch-board, where each of the above-named circuits is split in two, forming six separate inside circuits. The first of these circuits carries lamps Nos. 1 to 5 above the eastern gallery, and the second carries lamps 6 to 10 for use under the eastern gallery. In like manner the circuits Nos. 3 and 4 carry lamps Nos. 11 to 15 and Nos. 16 to 20 above and below the western gallery. The fifth circuit in the erecting shop carries lamps 20 to 25 in the centre and north-west corner, and the sixth circuit is held in reserve for contemplated extensions.

There are at present 25 arc lamps in the erecting shop, which is well lighted, and any of the above sets of four may be turned off at the distributing switch-board without affecting the others. The fourth switch on the main switch-board in the dynamo house has at present a circuit of five lamps only, which are used to light the yard. The circuit above contains over 2,000 feet of copper wire.

All the outside wires are of naked copper, and all the inside wires are insulated and protected by woodwork, when within reach. To all the outside lamps and to as many of the inside lamps as appeared desirable, hoisting gear has been applied on the counterbalance system.

The Crompton-Crabb lamp has already been described in these columns. It contains no trains of wheelwork, there being simply a rack and pinion, the axis of which carries a brake wheel. The lever which lifts the carbon rod acts also as the brake lever, and the arrangement is such that whether it be on or off the weight electrically supported is nearly the same. The latter point is one of its chief mechanical advantages. The regulation of the carbons is independent (within wide limits) of the variation of the coefficient of friction of the brake wheel, and even if the latter be wet or dry, dusty or greasy, the regulation of the arc is but little affected.

The lamps can be adjusted to burn from 10 to 20 ampères; the engine and dynamo could easily give 120 ampères, or 60 10-ampère lamps continuously. As, however, the workshops are high and well adapted for arc lights, the present lamps are adjusted for a current of 15 ampères, as being in this case the most economical, electrically or otherwise. The engine is one of Messrs. Marshall, Sons & Co.'s vertical 12 horse-power nominal, fitted with Hartnell's patent governor.

During the visit of the Mechanical Engineers to the works the lamps in the erecting shop were lighted, and burned admirably, but being daylight the effect was necessarily to a great extent lost. The installation throughout was thoroughly inspected, and it was felt that great credit was due to Mr. Wilson Hartnell, of Leeds, who erected the installation, for the manner in which he had designed and carried out the work.

A VOLTAIC CELL WITH A SOLID ELECTROLYTE.

WRITING in *Nature* of the 13th inst. on this subject, Mr. Shelford Bidwell expressed his belief that there has never hitherto been made a voltaic cell with a solid electrolyte which was capable of generating the smallest sensible current—at least at ordinary temperatures. Sir William Thomson found that when warm glass was placed between plates of zinc and copper, the existence of an electromotive force was indicated by an electrometer in connection with the metals, and Profs. Ayrton and Perry extended the observation to the cases of paraffin wax, gutta percha, India rubber, and shellac. But it is needless to say that with electrolytes of such enormous resistance no current could be generated of sufficient strength to be detected by any galvanometer, however delicate. He continued:—

"On June 27th I exhibited to the Physical Society a little cell consisting of plates of silver and copper, between which was contained a mixture of one part of copper sulphide with five of sulphur. When this cell was connected with a reflecting galvanometer it produced a current by which the spot of light was at once deflected off the scale, copper being the positive pole. The electromotive force was found to be ·07 volt, and the internal resistance 6537 ohms. The current, therefore, though far more than merely sensible, was small. Attempts were made to reduce the internal resistance by diminishing the proportion of sulphur contained in the mixture, but it appeared that as the sulphur was diminished the electromotive force was also diminished, until, when there was no free sulphur at all, the cell failed to produce the smallest measurable current.

"It occurred to me that the sulphur owed its efficacy to the fact that it formed a film of silver sulphide upon the surface of the silver plate by direct combination. I therefore made a cell thus:—A thin layer of copper sulphide was spread upon a copper plate and compressed into a compact mass against a surface of polished steel. A layer of silver sulphide was then spread upon the copper sulphide, and the cell was completed by pressing a silver plate upon the silver sulphide. The current which this cell produced through the shunted galvanometer was considerably stronger than that generated by the cell first described; but still the result was not quite satisfactory, and there seemed to be indications of short circuiting, which I thought might possibly be due to the penetration of particles of copper sulphide through the layer of silver sulphide. The silver plate was therefore removed from the cell, and, having been brushed over with a weak solution of sulphur in bisulphide of carbon, it was heated over a gas flame, and soon became covered with a uniform and continuous coating of sulphide. The heating was continued until all the free sulphur was evaporated. When the cell was reconstructed with this prepared plate it produced a current of 6,800 micro-ampères through an external resistance of ·2 ohm, and was able to deflect the pivotted needle of an ordinary coarse galvanometer.

"The dimensions of the cell are as follows:—The copper and silver plates measure $2\frac{1}{2}$ inches by 2 inches; the thickness of the two layers of sulphide (strongly compressed) is about $\frac{1}{30}$th inch; the E.M.F. is ·053 volt, and the internal resistance is therefore about 7 ohms.

"This cell seems to be exactly analogous in its action to a Daniell cell in which plates of copper and zinc are immersed in solutions of copper sulphate and zinc sulphate. Silver is probably the best (or only) possible metal for the positive plate, but some other metal might perhaps be substituted for the copper with advantage."

In last week's issue of our contemporary, Prof. Sylvanus Thompson wrote:—"Having been for some months occupied with the electrical behaviour of the compounds of copper, silver, and lead with tellurium, selenium, and sulphur, I can confirm the observation communicated to your pages by Mr. Bidwell as to the behaviour of sulphide of copper. He has constructed a primary cell with solid sulphides for the electrolytes. The smallness of the electromotive force which he has obtained is entirely due to the close proximity of copper and silver in the thermochemical series in respect to their heats in combination with sulphur. The theoretical electromotive force should be only ·05 volt.

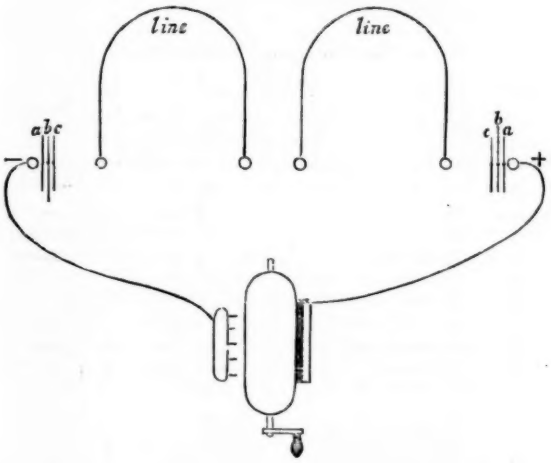
"Let me add to Mr. Bidwell's observation one of my own. If a piece of sulphide of copper is placed between platinum electrodes, a current of electricity from a battery can be passed freely through it, as it is a good

conductor. But if after a time the battery is removed and the platinum electrodes are connected with a galvanometer, a current is observed. The solid sulphide between two platinum plates constitutes, therefore, a secondary cell or accumulator capable of being charged and discharged."

ONE versus TWO ELECTRICITIES.

WHEATSTONE'S experiment of the revolving mirror is frequently instanced as being a proof of the existence of two electricities, and was, I believe, first devised by Professor Wheatstone to decide between the two rival theories. But I will endeavour to show that although the mirror experiment proves that there is a *motion* of the electricity beginning at both sides of the electric machine, and moving towards the middle of the circuit, yet it does not prove the existence of two separate electricities.

Referring to the diagram, let an electric machine establish a true positive potential at + and a true negative potential (according to Prof. S. P. Thompson's definition) at — ; then, since there is a difference of potential between the right hand ball at + and



the adjacent molecule, *a*, a transference of electricity will take place from the ball to the molecule of air, *a*, and the molecule of air, *a*, then having a higher potential than the next molecule of air, *b*, a transference of electricity from *a* to *b* will take place ; and so on until the other ball is reached.

Similarly with the two balls connected to the — collector of the machine, the left hand ball will have a lower potential than the adjacent molecule of air, *a*, and a transference of electricity will take place from *a* to the ball, then *a* will be of a lower potential than *b*, and a transference of electricity will take place from *b* to *a*, and then a transference from *c* to *b*, and so on until the other ball is reached ; the motion of electricity being always from right to left, while the motion of the spark at the — side of the machine is in the reverse direction to that in which electricity moves.

W. MOON.

The Telephone in Russia.—According to the rules under which the telephone companies are formed in Russia, 10 per cent. on private subscriptions and 5 per cent. on those of municipal and Government corporations are paid over to the Treasury ; 5,000 roubles in the capitals and 2,000 roubles in provincial towns being the minimum. In 1883 the revenue derived from this source exceeded 22,000 roubles, in 1884 it was about 25,000 roubles, while that for the present year is expected to reach 40,000 roubles.

LIGHTNING RODS.

ON installing a lightning conductor on a house it is often recommended to connect to it not merely any iron-work, &c., in the roof, but also the gas and water pipes.

Theoretically, this advice is wise ; but in practice its application may give rise to serious accidents if care is not taken that the connections have a surface large enough not to be fused by the passage of the lightning. and especially that there is no breach of continuity in the system thus formed.

As regards the water pipes, *e.g.*, there are curious instances, writes M. P. Delahaye in the *Revue Industrielle*, of the consequences which may follow from the interposition of paint, varnish, or cement for the protection of the metal or of the joints. At Fitchburg (Massachusetts) it has been found that an excess of precaution is not needless. During a violent storm two houses were struck by lightning, one in Burnap Street, and the other in Milk Street. In both cases the lightning followed the water pipes from the houses to the mains, which were of 100 to 150 millimetres thickness of iron, with a coating of cement. From thence it left remarkable traces of its passage. Sometimes a pipe was split from end to end, sometimes it was pierced with numerous holes, indicating, in the majority of cases, that the electricity had traversed the metal from the outside inwards. Almost all the joints for a length of 2,000 feet were open ; an inspection-hole and two fire-plugs were injured, so as to be useless. The expenses of repairing this part of the service exceeded 8,500 francs. Several times the mains in the streets have been thus injured by lightning, and the recurrence of these accidents has given rise to investigations which it may be useful here to summarise.

The iron pipes are eight feet in length, and are coated inwardly with cement (!) to the thickness of 12·5 millimetres, and externally to the thickness of 12·5 to 25 millimetres. In laying them down the ends are brought into contact, and the joint is made by a wider external piece filled with cement of about 150 millimetres in length, so as to obtain the necessary water-tightness. Two consecutive pipes generally do not touch each other, but are separated by a thickness of three to six millimetres of cement.

On examining the injured pipes they were generally found broken for their entire length ; then in three or four consecutive pipes there was no trace of the passage of the lightning to the external coating of cement, but at each joint there are from one to ten holes, of from two to eighteen millimetres in diameter, pierced from the outside inwards. An outer piece was cut extremely neatly ; finally the electricity made its escape by an inspection-hole or a fire-plug.

The water mains at Fitchburg have been seriously injured five times by lightning, and each time in the same manner ; that is to say, by the lightning passing through the houses and directing itself into the mains until it came to a flood-gate. Each time the old pipes coated with cement have been the only ones attacked.

The system above described is not, to our knowledge, in use in France ; but there exist a certain number of joints with the interposition of rings of caoutchouc, which to a certain extent may also be said to fail in forming the metallic continuity necessary for the passage of an electric current. The ears and nuts by which the junction of the pipes is effected rust easily, and form altogether but an indifferent conductor. The same observation is applicable to gas piping.

It is therefore prudent under such circumstances to set theory aside, and to leave to the lightning rod alone the duty of conducting the electricity into the ground, without exposing ourselves to unforeseen accidents in consequence of a defective joint, whether in the house itself or in the street. It is already not so easy to erect and maintain a lightning conductor in the condition requisite for security. Most of these appliances, for want of due inspection, offer merely an illusory protection, and their share of responsibility is large enough without any increase.

SHOULD PROFESSORS PRACTICE?

THE question whether professors of engineering in technical schools should at the same time engage in private practice or not, is one which is of some interest, and the answer of importance. As a fact not a small proportion of these gentlemen have long handed in their replies, remarks the *American Engineer*, by taking in all the practice they could possibly reach and attend to.

Indeed this is claimed to be one of the abuses of the technical schools, and as not infrequently pursued, it cannot be classed otherwise. There have been—there are still—professors of engineering who have traded on their connection with the technical school by endorsing mechanical appliances and engineering schemes of doubtful and spurious character, who have neglected the students outrageously in grasping after outside work and its financial remuneration.

The first duty the professor owes to his students. Still it may be questioned by some whether, without attending to some outside work, the incumbent of the chair of engineering can do the fullest justice to this very trust. They maintain that he must have his hands, to some degree at least, in practice, to give the students the benefit of actual work in design and test, or of the knowledge accruing from the latter.

However that may be, it is certain that only to that extent by which the students will profit by such outside practice, is the professor justified in attending to it. The advertising value attached to outside work, we distinctly proclaim to be unnecessary, and of itself detrimental to the best interests of the school.

But how shall this limit of efficient practice just alluded to be fixed? Financial remuneration for outside practice is so large for professors connected with prominent technical schools, while the salaries paid are comparatively small, that there is the ever-present tendency to accept as much outside practice as possible, even if the time and energy thus devoted mean a lack of proper attention to the students and their course.

This is a fine point to settle. Given a man of the highest honour, who loves his work as a teacher, who does not connect himself with a technical school to abuse the trust as a means of making money, and the point is soon settled. Such a gentleman may be relied upon to discover the proper limit of outside practice.

But given the other kind of incumbent, and if he is to be retained in the school at all—the advisability of which may be questioned—the trustees must step in, and firmly define the limits for him.

We do not believe, on the other hand, in having as professors of engineering men who have no knowledge of business methods, and who, despite theoretical attainments, have no capacity to engage in outside, practical work. These are apt to be dreamers, and are scarcely fit to inculcate the class of theoretical and practical knowledge in the student, and to impart to him the method of judgment and work, which will enable him to make headway in practical engineering.

THE ILLUMINATION OF TEMESVAR.

IN Vienna, as elsewhere, the electric light has many enemies, and enmity makes people blind, even to the best light. If the question is to carry out an experiment with the electric light on the smallest scale, either in public or in private, every florin is higgled over and every item objected to. But to maintain gas in its untenable position dozens of millions are expended without a thought. The attempt is made to carry on a war with antiquated weapons while the opponent equips himself with newer and undoubtedly more efficient arms. That the electric light makes gigantic strides in comparison with the earlier days of gas, is quite overlooked. But a capital city will probably soon give a good example in public lighting, and this may be effectual, remarks *Zeitschrift fur Electrotechnik*; example is better than all arguments and we have one close at hand, in the Empire.

If, four years after the introduction of gas into a town like Temesvar, there had been as few drawbacks as have occurred with the electric light, gas would have flourished exceedingly. In Temesvar there have been no shortcomings in the working beyond the heating of the axle of an engine. The electric installation, machines, insulators, commutators, conductors and lamps all prove satisfactory, the lamps especially. The following table gives the destruction of lamps since November last, with their causes, and the time that they last.

Date of coming into use.	Cause of destruction.	Burnt out.	Other causes.	Hours burning.
1884.				
December 14	Carbon burnt out	1	—	612·5
„ 15	„ „	1	—	612·5
„ 17	„ „	1	—	529·5
„ 23	Wire broken	—	1	612·25
„ 26	Burnt out	1	—	612·25
1885.				
January 1	Wire broken	—	1	—
„ 14	Burnt out	1	—	1048·5
„ 19	„ „	—	1	—
„ 19	Broken glass	—	1	—
February 7	„ „	—	1	1366
„ 10	Mischievously broken ...	—	2	—
„ 22	Burnt out; glass broken ...	1	—	1526·75
„ 25	Burnt out	1	—	1445·25
March 18	„ „	1	—	1806
April 6	„ „	1	—	1998·5
„ 16	„ „	1	—	1449·25
„ 29	„ „	1	—	2188·5
May 6	„ „	1	—	2238
„ 17	„ „	1	—	2305·5
June 5	„ „	1	—	352
„ 6	„ „	1	—	2434·25
„ 6	Broken	—	1	2434·25
„ 6	„	—	1	2434·25
„ 6	„	—	1	2434·25
„ 9	„	—	1	2451·50
„ 9	„	—	1	2451·50
„ 14	Burnt out	1	—	2480·25
„ 20	Broken	—	1	2511·50
„ 27	Burnt out	1	—	2549
July 2	„ „	1	—	2574·25
„ 5	Broken by hail	—	1	2590
„ 5	„ „	—	1	2590
„ 5	„ „	—	1	2590
„ 16	Broken	—	1	2651·75
		18	17	

We refrain from all comments on these results.

It seems to us not uninteresting to append an official statement on the duration of lamps of other systems. During the Philadelphia Exhibition the Franklin Institute undertook to carry out measurements of the machines and lamps, just as had been done in Paris, Munich, and, on a larger scale, in Vienna. The Scientific Commission in Philadelphia requested all the electric light companies in America to submit their lamps to trial.

All the American companies accepted this invitation except the Brush and the Sawyer-Man, the former of which, to the best of our knowledge, produces only arc lamps of an especial construction.

The lamps were to burn for 600 hours, a time corresponding to the duration guaranteed by the companies. The time of action of the surviving lamps was then extended to 1,000 hours. The first period, that of 600 hours ended in May this year, and the trial gave the following results:

Of 20 Weston lamps there survived ...	8
Of 20 Stanley „ „ „ ...	4
Of 10 Woodhouse and Rawson lamps there survived	1
Of 20 Edison lamps there survived ...	19

The performance of the lamps was then determined as follows :

1 normal candle in		Weston's lamp requires	3·6	watts.
1 „	„	Woodhouse & Rawson's lamp requires ...	3·8	„
1 „	„	Stanley's lamp requires	4·	„
1 „	„	Edison's „ „	4·4	„

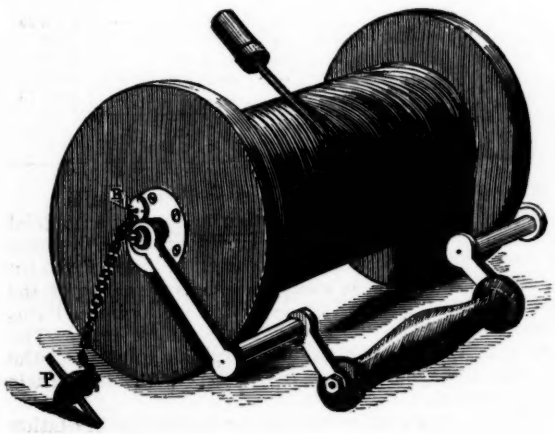
From the trials of the Scientific Commission at the Vienna Electrical Exhibition, and from more recent measurements we have the following results :

1 normal candle,		Siemens Bros.	4·5	watts.
1 „	„	Cruto ...	4·3	„
1 „	„	Müller ...	4·1	„
1 „	„	Swan ...	3·5	„
1 „	„	Gatehouse ...	3·4	„
1 „	„	Lane-Fox ...	3·2	„

Recently the Edison lamp, with a luminous power of 16 normal candles, has been made for an E.M.F. of 100 volts and a strength of current of 0·5 ampère. It requires, therefore, 3 watts per candle. Gerard's lamp requires, per candle, only 2 watts ; that of Siemens and Halske, 3·4 ; whilst Cruto requires for 32 candle lamps only 3·1, and for 100 candle lamps only 2 watts.

IRISH'S EXPLODER.

THE little instrument shown in the sketch, brought before our notice by Mr. Macadam, consists of a wooden drum, in the interior of which are chloride of silver cells and an induction coil. On its exterior is coiled a double conductor of any desired length, at the end of which is attached a fuze. When this latter is placed in position the drum is carried to any convenient distance from the scene of the explosion. To ignite the fuze one end of the little plug, P, is inserted into a hole, B, at one extremity of the drum, and contact is made. A second shot, however, could not be fired, nor a spark



created between the wires of the exploded fuze until an unlocking operation has been performed, no connection being available until a spring, which forms part of the electrical contact, has been released. This is accomplished by inserting the other end of the plug, P, into the hole, B, and giving it a slight turn. The apparatus is then ready to effect another explosion.

We do not think, however, that the use of such galvanic elements as chloride of silver cells are at all satisfactory for this purpose, these sealed cells being of but little value for anything other than cable testing. The gas igniters, even, operating on this plan are not to be depended upon for any lengthened period.

AN ELECTRIC ORGAN.

THE following description of an immense organ, which is played by the aid of electricity, is given in the *Chicago Journal of Commerce* :—

The largest organ in the world, with the exception of the one at Riga, Russia, is in the Cathedral of the Incarnation at Garden City. Its capabilities were tested June 13th by George W. Morgan, who gave an interesting recital before a large number of ladies and gentlemen. The instrument, which was built by Mr. Hilborne L. Roosevelt, is distributed in four distinct and widely-separated localities of the cathedral, although the whole is under the control of one performer, through the agency of electric action. In an octagonal chamber, built for the purpose in the angle formed by the transept and chancel walls, is the largest portion of the instrument. The organ is here divided into floors, or stories, and in the basement are the engine, countershaft, &c. Above this, on a floor of brick and iron, are the bellows and the windchest, on which rest the 32-foot pipes. The great organ windchest, with that for the reeds and mixtures of the pedal organ, are on the next level, and then follows the swell organ, and, above all, the choir. Each of the three manual windchests is furnished with its own auxiliary reservoir, or regulator, where the wind is reduced to the pressure needed for that department.

In the tower at the western end of the cathedral is the most important division of the organ. In the room, which is 15 feet square, and is high enough to admit of one windchest being supported above another, are placed parts of the great, swell, and pedal organs, and the whole of the solo organs, the second of these being above the first, the third at one side, and the fourth at the back. In the chapel beneath the cathedral is the third section, which is provided with claviers of its own, so that it may be made independently available for chapel purposes. This comprises a part of the choir organ, divided here between the two manuals and two of the pedal stops. Its tone rises into the church through the different staircases, and the distance lends enchantment to the sound. The last part consists of the echo organ and one pedal stop, which is placed between the ceiling and the roof, above the intersection of the nave and transept. The mysterious source of the tone produces an interesting effect. The vox humana sounds are especially realistic.

Steam power is used in inflating the bellows. One engine is placed beneath the chancel division to supply it with compressed air, and another beneath the tower to operate the bellows of the chapel division, and the magneto machine, which generates the electricity. All the wires used in making the electric connections of the instrument stretched out in a continuous circuit would extend over a distance of 21 miles. This summary will give an idea of the resources of the instrument :—

Great organ ...	...	...	31	stops	2,406 pipes.
Swell „ ...	...	...	27	„	1,942 „
Choir „ ...	...	...	23	„	1,444 „
Solo „ ...	...	...	7	„	427 „
Echo „ ...	...	...	7	„	382 „
Pedal „ ...	...	...	20	„	651 „
	Total	...	115	stops	7,252 pipes.

There are 9 couplers, 11 mechanical accessories, 11 adjustable combination pedals, 9 vental pedals, and 3 miscellaneous pedals.

The recital given by Mr. Morgan brought out many of the fine qualities of this noble instrument, and the organist himself afterwards praised it warmly.

Electric Lighting of Theatres, &c.—McVicker's theatre, at Chicago, said to be one of the most beautiful in existence, has 1,200 incandescent lamps to illuminate the interior and three arc lamps outside. Other places of amusement in Chicago are to be lit by electricity, notably the Opera House, which is to have over 600 Edison lamps.

THE FIRMNESS AND DENSITY OF CARBON FILAMENTS.

IT is to be expected that those carbon filaments which possess greater firmness as against mechanical rupture must better resist the disaggregation of the matter on the transit of the electric current. This disaggregation of the carbon filament may have a twofold cause, writes Dr. J. Puluj in *Zeitschrift für Elektrotechnik*, the heat action of the electric current and the high tension of the latter at both ends of the filament.

On heating the filament its particles are thrown into strong molecular motion, and if its energy is greater than that of the cohesive force between the particles the latter are torn away from the filaments and are deposited upon the sides of the glass. The filament is thus gradually dissipated as dust.

On the passage of the electric current through a carbon filament there occurs, also, a transmission of electric energy between the extremities of the carbons through the attenuated gas, so much the stronger the greater the difference of potential of the electric current at the extremities of the carbon. In consequence of this transit of electric energy through the vacuum small particles are mechanically carried along at the negative extremity of the carbon and projected away, which gives rise to a pale blue nebular light, which is identical with the light in Geissler's tubes. The transfer of electric energy takes place here in such a manner that the dynamic electricity is converted into negative static electricity, and is conveyed to the sides of the glass globe and to the positive extremity of the carbon by means of the particles of carbon which are torn away. If the current is very powerful, and if the carbon filament is brought to the most intense white heat, the nebular light fills the entire globe, and gives a bluish tone to the otherwise white light.

Of what great importance the production of an absolutely firm carbon filament is in the manufacture of glow lamps will appear from the following.

A glow lamp is the more economical the longer it lasts, and the smaller the electric energy which is required for the production of a given luminous power at a normal white heat of the carbon filament. By "normal white heat" I understand the yellowish white glow of the carbon filament in which the prismatic composition of the light-rays is approximately identical with that of the light of a gas flame. If one glow lamp is to be more economical than another, as far as the consumption of the current is concerned the mass of the carbon thread must be smaller—and the thread itself consequently thinner—because in this case a smaller quantity of heat suffices to raise it to whiteness. On the other hand it is clear that this economy in the consumption of the current, with one and the same sort of carbon, can be effected only at the cost of the permanence of the lamp, since a filament is the more rapidly destroyed by the passage of the electric current the thinner it is. But if it is found practicable to produce a filament of great absolute firmness its thickness may be diminished without decreasing the permanence of the lamp in comparison with others. The greater the absolute firmness of the filament the more economical must be the lamp in comparison with others, always supposing that the lamps are treated normally, and that the permanence of each is equal.

Induced by this consideration I determined in June, 1884, the absolute strength of carbon filaments of my own production and of those of the Edison lamps. The experiment was carried out as follows :—

A piece of the filament to be examined, k, as straight as possible, was brazed to two platinum wires, p, p, or only fastened with sealing wax. It was then fixed to a small hook in the manner shown in the figure.

After previous determination of the thickness of the filament with an apparatus capable of measuring 0·001 millimetre, shot was gradually put into the capsule, s, until the carbon filament breaks not far from its middle. The weight of the shot and the capsule, divided by the section of the carbon filament in square millimetres, gives the absolute modulus of strength of the carbon filament.

Edison carbon of the square section $0{\cdot}21 \times 0{\cdot}21 = 0{\cdot}0441$ square millimetres. In the following, P stands for the load in kilos. by which the individual filaments were ruptured :

P =	0·468 kilo.
	0·458 „
	0·330 „
	0·525 „
Mean	0·445 kilo.

The weights at which the carbon filaments tear vary between 0·330 and 0·525 kilo. This may be explained by the fact that the filaments have perhaps not been quite straight, and have thus been not merely torn but partially broken. It is also possible many filaments may have a smaller section at the place of fracture, or an incipient fissure. Hence in repeating such experiments it is recommended to examine the filaments previously with the microscope, and likewise afterwards, to determine the section at the line of rupture.

On dividing the mean weight P = 0·445 kilo. by the section of the filament, Q = 0·0441 square millimetre the modulus for Edison's carbon is found to be

$$M = 10{\cdot}1 \frac{\text{kilo.}}{\text{square millimetre}},$$

meaning that an Edison carbon filament of 1 square millimetre section would not tear with a load less than 10·1 kilo.

(To be continued.)

ANOTHER TELEPHONE TRANSMITTER.

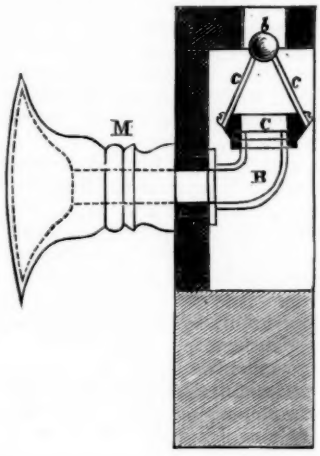
OUR readers have been, through the medium of our columns, made fully acquainted with the various apparatus forming the telephonic system of Professor Silvanus Thompson, including his valve transmitter. A somewhat similar instrument to this has been devised by Mr. Irish, whose magneto telephone we illustrated last week, and we are inclined to the opinion that better results are to be obtained therewith than we have yet heard from the Thompson instruments.

We believe, however, that the latter considers the apparatus of Mr. Irish to come within his patent rights ; but with this we have nothing to do.

The drawing shows part of the containing case, where M is a mouth-piece communicating with a brass elbow joint, B, at the end of which is attached a carbon ring, C, of the section shown. Screwed to the outside of this ring are three carbon projections, c, two only of which are shown, each about $1\frac{1}{4}$ inches in length, $\frac{1}{8}$ inch in width, and $\frac{1}{16}$ inch thick, at equal distances

apart; supported on the top of these is a little carbon ball, *b*.

The action of the transmitter will be readily understood without further explanation, for both this and the



instrument of Professor Thompson appear to be very similar to the cup and ball microphone devised several years since by Mr. Strangways. Mr. Irish is evidently of a very inventive turn of mind, and we should be glad to see him direct some of his ideas to profitable account.

REVIEWS.

Manual of Electrotechnics. Compiled by Dr. ERASMUS KITTLER, Professor in Ordinary at the Grand-ducal Technical High School of Darmstadt. Stuttgart: Enke. (Handbuch der Electrotechnik. Bearbeitet von Dr. Erasmus Kittler, Ordentlich. Professor an der Grossherzoglich, Technischen Hochschule in Darmstadt.)

We have here before us merely the first half of the first volume of this work, and we further learn from the prospectus given on the fly-leaf that for the present, at least, telegraphy, telephony, railway signalling, and connected subjects are excluded. Hence we may conclude that other departments of electrotechnics will be discussed with great comprehensiveness.

There is neither table of contents nor index, a deficiency which does not assist the reader in obtaining a clear view of the work. On the other hand, the illustrations in the part before us are no fewer than 226 in number, and are both well selected, with a view to an understanding of the subjects, and clearly executed. This first half is divided into three parts, which we may call books, and each of these is resolved into a number of chapters. In the first book, treating of Induction, we find the consideration of the magnetic field of induction in linear conductors, including the fundamental laws of induction, special cases of magnetic induction, voltaic induction, the general properties of the electromotive force of induction and the phenomena of self induction; induction in material conductors, including special cases, and the reaction of the currents induced in material conductors; next follows an account of the inductorium.

Book B takes up the principles of the more recent machines for producing a uniform current. Here the first chapter is devoted to the armature in its two best-known forms, the Paccinotti-Gramme ring and the von Hefner-Alteneck drum inductor. There is also an account of various modifications of the Paccinotti ring, such as the flat ring, suggested by Gramme, and developed by Schuckert. The author next considers the phenomena connected with the short circuit of the armature bobbins, and concludes this chapter with general remarks on the construction of the armature and on that of the commutator (collector) and the brushes. In the second chapter of this book, treating of the magnetic field, are considered the measurement of the intensity of such fields, the dependence of the temporary magnetic moment of soft iron rods on the magnetising power; its dependence on the dimensions of the iron cores, and on the nature of the iron. The third chapter treats of the reactions of the induction currents which arise in the armature upon the magnetic field; whilst the fourth is of a historical character. Here the author, whilst mentioning the common classification into magneto-electric machines with permanent steel magnets, and with separately excited electro-magnets, and into dynamo-electric machines whose field magnets lie in the main circuit (pure or ordinary dynamos, series machines), such whose field magnets are placed in a lateral circuit (shunt machines), and such as have a complex wrapping of the field magnets, He prefers, however, the following classification: the Paccinotti-Gramme system, the von Hefner-Alteneck system, the Brush system, and, lastly, the various machines with disc armatures, with pole armatures, with unipolar induction, &c.

The third book, C, is devoted to the art of electric measurements, with particular reference to constant current machines. In the first chapter we find an account of the absolute system of measurement. The second chapter discusses the theory of electrical measuring instruments, the tangent galvanometer, mirror reading, the sine galvanometer, the electro-dynamometer, electrometers, voltameters, rheostats, and normal elements.

The third chapter treats of the measurement of resistances, and, firstly, of solid conductors, with an account of the differential galvanometer, the bridge, of conductivity, of the measurement of very high resistances, of galvanometers for measurements of resistance; and, lastly, the determination of the resistances of liquid conductors.

The fourth chapter, on the determination of the strengths of currents, comprises methods for the measurement of currents and technical galvanometers. The fifth chapter expounds the determination of differences of tension, and describes the instruments applicable to this purpose.

So far as this work is before us it fully carries out the promise of the prospectus, being both as regards theory and practice on the level of the most recent discoveries and inventions. At the foot of the pages are abundant references to original memoirs, for the benefit of readers who wish to study any part of the subject more in detail.

Electrolysis: A Practical Treatise on Nickelling, Coppering, Gilding, Silvering, the Refining of Metals and Treatment of Ores by means of Electricity. By HIPPOLYTE FONTAINE. Translated from the French by J. A. Berly. E. and F. N. Spon, 125, Strand, London.

The author's apology for publishing this work is the fact that treatises of the kind in France are few in number, and are also antiquated. A good deal has been written on the subject by French authors, but the matter has appeared in scientific journals and not in book form. The volume of M. Fontaine is divided into four sections; the first is devoted to theory, the second deals with the description of the principal batteries and dynamo machines used in electro-chemistry; the third section treats of electro-deposition, nickelling, silvering, gilding, coppering, &c.; and the fourth relates to the refining of metals and the treatment of ores.

A good deal of the theoretical portion of the book is perhaps rather unnecessary, as those who have to deal with electro-typing and electro-plating would hardly trouble themselves with information which has but little direct bearing on the subject. A collection of

tabular data, however, which are given are of considerable practical value. In Section II., in the first chapter various forms of batteries are described, but some of the types are, we fancy, not such as could be actually employed in electro-plating, &c., work. The thermo piles of Noé and Clamond, which are illustrated, would seem to be well adapted for electro-plating small articles, though for general electro-deposition they would not prove economical; it is stated, indeed, that one cubic metre of gas would in a Clamond battery develope a maximum power of 5 kilogrammetres only, whereas the same quantity of gas in an Otto gas engine developes 75 kilogrammetres. We next have general descriptions of various dynamo machines, the cost and sizes of the different types being given. In this chapter we notice the following remarks with reference to nickel-plating:—"If nickel-plating has regained favour only during the past few years, it is not because better or new solutions have been found, but because the electric industry has become enriched with a source of electricity better, more constant, and infinitely cheaper than the batteries. We mean the Gramme machines, which have caused a real industrial revolution, and which have rendered inestimable services in electro-chemical depositing manufactures." As regards cost, we find "with the battery the deposition of a kilogramme of silver entailed an expenditure of 3·87 francs for the galvanic current. With the Gramme machine, taking into account the value of the motive power, the interest of the capital, and the wear and tear of material, the cost of depositing silver is reduced to ·94 franc per kilogramme." It is pointed out that although this saving is not of much consequence in the case of the deposition of the precious metals, yet in the case of copper, tin, iron, or nickel, it is a matter of importance. In considering the electrical efficiency of electric generators, the author gives the results of a number of experiments which, though interesting, are, perhaps, more suitable for a work on the electric light than on electrolysis. Section III., which practically commences the subject of electrolysis, is very good in the main, but might with advantage have been a little fuller. Besides the deposition of nickel, gold, silver, and copper, which are dealt with at length, the various baths for depositing other metals are given, but practically none of the details essential to enable success to be obtained are given; thus, in the case of platinum, the description is such as would lead anyone to suppose that there are no particular difficulties in the way, whereas, we believe, it is really almost impracticable to obtain success, and, in any case, no one has ever succeeded in depositing more than the thinnest possible film of the metal; the statement that the current required for the purpose should be *moderately* powerful, is rather vague. As regards the deposition of zinc, it is stated that "we do not believe that any industrial results have ever been obtained." With reference to this statement, we read in the first volume of "Miller's Chemistry" that the iron links of the Clifton suspension bridge, each being 24 feet long, were successfully coated with zinc by electro-deposition, the links being immersed in a sulphate of zinc solution, and a feeble current being used. In Section IV. we have electro-metallurgy dealt with. This subject is of great importance, as it enables the operation of refining metals to be effected without the direct action of fire; thus water power could be used for the purpose in many cases, but, as it is pointed out, the interest on the capital absorbed may, in some cases, exceed the gross profits realised by the operation. The subject is treated with a considerable amount of detail, more, in fact, than has been given in other portions of the book. The processes of extracting metals from their ores by electricity appears to be still an unsolved problem. M. Fontaine states that "as regards copper, lead, and zinc ores, the cost of treating them by electricity will, whatever be done, be an almost insurmountable obstacle to its general use." As regards the translation of the book, the fact of its being undertaken by Mr. Berly is a sufficient guarantee of its excellence.

THE ELECTRIC LIGHT ON THE CANTON RIVER.

THE Hong-Kong *Daily Press* gives some particulars of the "search" lights employed on the Canton River to guard the torpedo fields and fortifications from a night attack during the recent war.

The lamps arrived last summer by the *Glenogle*, and were quickly fitted and placed in position at the stations assigned to them, and have been working most satisfactorily ever since. Each set of apparatus consists of engine and boiler, dynamo, projector, double conductor cable, and lamp, with the necessary switches, keys, and testing instruments. The engine is of 14 horse-power, improved portable type, with two steam jacketted cylinders and patent automatic expansion apparatus, feed water heater, &c., mounted on wrought iron travelling wheels and with wrought iron undergear and shafts. It is governed to run at 110 revolutions per minute with 80 lbs. of steam, the most favourable working pressure.

The dynamo machine is of the improved Gramme form, D. Q. pattern, and is driven by belting from the engine, but can be arranged to work direct from the shaft without any belting. When running at 470 revolutions per minute, it gives an electromotive force of 60 to 62 volts and a current of 90 to 95 ampères, with an arc in the lamp of $\frac{1}{4}$ to $\frac{3}{8}$ inch. Two sets of spare brushes are supplied with each machine.

The double conductor cable is of high conductivity copper strand, insulated with India rubber, and laid up together, wormed and taped, so as to form one cable of 100 yards in length, thus enabling the projector and lamp to be placed in any position most favourable within 100 yards of the engine.

The projector, or lantern, is that known as the "Mangin," with coplanetic mirror, 90 centimetres in diameter. Either a long horizontal band of light, covering 12 degrees, may be shown, or the light can be centred on one spot. The projector is fitted with a telescope, vernier scale, graduated sights, sliding doors, and a ground glass lens to enable the operator to adjust the length of arc, &c.

The carbons are 20 mm. in diameter, and with the dynamo running at 470 revolutions will give a light of 36,000 candle-power.

One light station is at Whampoa, the lamp being placed on a hill about 100 feet high, so as to sweep both channels of the river at the point where it divides and forms the two passages to Canton. The light can also be thrown on the face of each of the three forts at this spot, on both the barriers, the torpedo fields, and the military bridge, while it is itself well protected from the enemy's fire. Another lamp is placed in position at the Bogue forts, so as to sweep the channel from Sam-pan-chow to South Wantong.

The extreme range of the light is about three miles. At that distance the movements of a steam launch or ship's cutter can be distinctly followed. Of course a dark clear night is most favourable to the light. As an instance of the power of the lamps, Captain Stewart, of H.I.C.M.'s *Chen To*, recently reported that he was able to read a newspaper on the deck of his ship by the light when moored at a distance of one and a half miles from the lamp. Again, last June the light was suddenly turned on the town of Tai Ping, near the Bogue, and upwards of three miles from the lamp station. The light disturbed some soldiers who were plundering a house, and who, finding themselves enveloped in a dazzling blaze of light, threw down their booty and fled in terror, but being recognised were afterwards captured by the guard. The whole of the apparatus was supplied by the Silvertown Telegraph Works Company, London, E., and was fitted up by Mr. Betts, C.E., assisted only by native labour.

The United Telephone Company v. Bassano and Slater.—We have reason to believe that the case recently decided by Mr. Justice North will shortly be carried to the Court of Appeal.

ELECTRIC LIGHTING AT THE INVENTIONS EXHIBITION.

THE electric illumination of the grounds and fountains is under the direction of Sir Francis Bolton, from whose room in the tower overlooking the grounds the whole lighting of the gardens and fountains is controlled. The 9,020 lamps are distributed about the conservatory, east and west quadrants, east and west arcades, upper gardens, lower gardens, and the Albert statue. There are six distinct circuits, which are further subdivided into twenty-eight smaller circuits, each of which starts from a common switch-board, to which the current is led from the two dynamos. In connection with the switch-board is an electro-dynamometer, so disposed that the current from either dynamo, or the current entering any individual circuit, can be instantly directed through it without any break of continuity. In each of the main circuits there is placed a pair of mercury contact cups bridged over by a fork, one leg of which extends into each cup. This fork carries the core of a solenoid, and when a current is turned through this solenoid the fork is lifted out of the cups and the circuit broken.

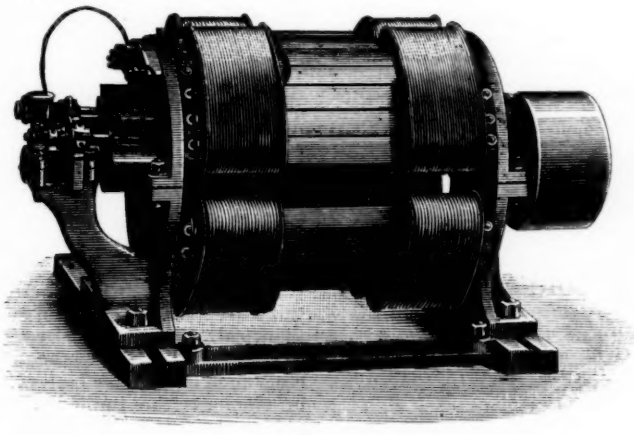


FIG. 1.

All the solenoids are connected by wires to Sir Francis Bolton's room, and it is by them that he is enabled to turn the lights on and off. The return circuits are gathered together into a common conductor, which is also provided with four sets of mercury cups and solenoids, arranged in series. Around each set of cups there is placed a by-pass circuit containing a resistance of such a size that when the circuit is broken at these cups the current is diminished, and the brilliancy of the lamps reduced by a determined amount, the four sets corresponding to three-quarters, one-half, three-eights, and a quarter of the total illumination.

The lamps are made by the Edison and Swan Company, and are chiefly of 5 and 10 candle-power, only a few 20 candle-power lamps being used on the band stands and the verandah of the conservatory. These are arranged in compound parallel circuits containing eight in a group, the electromotive force in the mains being 250 volts. There are 14 miles of main and branch wire, nine miles of twin wire, and two miles of small connecting wire.

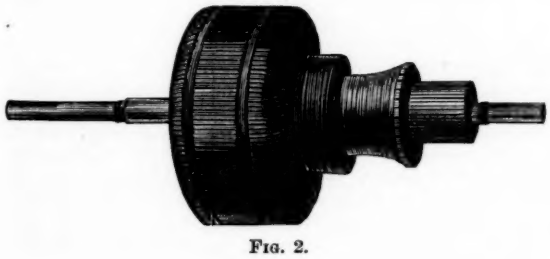


FIG. 2.

One of the most interesting features of the illumination is the play of the fountains. Below the island in the fountain is a water-tight chamber about 5 feet in height and 20 feet square, into which one obtains access by first descending a ladder from the diving apparatus-house into a low arched passage, from which one ascends into the chamber. The roof of this is covered with water-pipes which convey the water from the main in all directions, the supply being regulated by screw valves; the five large jets are fitted with plug valves and levers, by the manipulation of which the dancing motion and breaking up into water-drops of the columns of water are effected. The average quantity of water expended per hour during a fountain display is 70,000 gallons. Under the five large water jets are five sky-lights, fitted with thick glass, below each of which is placed a wooden box, containing a powerful arc light with the carbons set horizontally. Over the top of the lantern is a holophote, such as is used in lighthouses, by means of which the rays of light are concentrated, and projected upwards into and with the column of water, whilst their colours are varied by drawing sheets of stained glass across the lantern. The water is supplied at a pressure of about 70 lbs. to the square inch, which is sufficient to carry it up to a height of 120 feet.

On one of the walls of the chamber is a board, on which are signalled the instructions from the tower, which are read off by an assistant to the staff. In this manner the various effects which more or less puzzle the spectators are telegraphed from the tower above, and carried out in the concealed chamber below.

Amongst those who this year make their first appearance in the electric lighting department of the exhibition, are Messrs. J. D. F. Andrews and Co., of Glasgow, a firm whose name has been frequently mentioned in our columns in connection with important ship lighting contracts.

The Andrews dynamo is a four pole Gramme machine, arranged in a novel way, as will be seen in fig. 1. The armature, fig. 2, rotates within a cylinder, nearly three times as long as itself, and formed of wrought iron bars arranged like the staves of a cylindrical cask. The cylinder or cask, to keep to our simile, is not entire all round, some of the staves being omitted so as to create four longitudinal openings 90° apart. These staves form the field magnets, the central portions being the poles, the bobbins being arranged at each end of each group. There are no pole pieces, and consequently there is no break in the magnetic field except at the neutral points, where the framing acts as a coupling between the adjacent magnets. A special feature of the machine is the method of connecting up the coils of the armature to the commutator, which we shew in fig. 3. N, N_1, and S, S_1, represent the staves

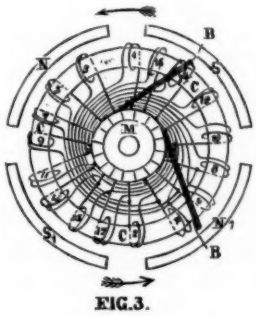


FIG. 3.

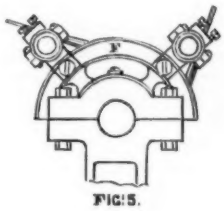


FIG. 5.

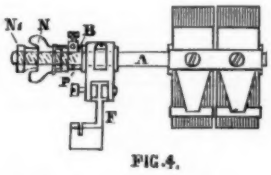


FIG. 4.

forming the poles, and C, C, C, the armature with its coils, and M the commutator. It is necessary, according to this method of connecting, that the number of coils should be uneven; usually 59 are employed, but only 17 are shown. The coils are connected in series, not, however, each one to its next door neighbour, but each one to its diametrically opposite neighbours—that is, coil No. 1 is joined between Nos. 17 and 2, and No. 2 between Nos. 1 and 3, and so on; one end of each coil, however, is connected to the commutator plate nearest to it, as will be better seen on the diagram than described. The collection of the currents from these

coils is effected by placing two brushes, B and B, at right angles to each other on the commutator; thus, as coil No. 1 enters field N, its other half, or coil No. 2, which is connected to it, enters field N_1, and brush, B, collects the current. Correspondingly, as coil No. 10 enters field S, and its other half, No. 11, field S_1, the brush, B, is in position to gather the current from both south poles. The adjustment of the brushes on the commutator is another new feature of the dynamo. On an axle, A, fig. 4, are held two brushes in one holder; this axle passes through an insulated brass sleeve or bearing, B, and its screwed end fits into the thumb nut and lock nut, N, N_1. When the thumb nut is turned, the brush axle is drawn through the sleeve, and a pin, F, fixed to the axle and fitting into a spiral slot in the sleeve causes the axle to turn and press the brush on to the commutator, or lift them entirely off, and with this simple arrangement the pressure can be very finely adjusted. Fig. 5 is an end view, showing the two brush-holders fixed to a semi-circular brass frame, F, upon which they can be shifted independently and the angle adjusted, and after this the frame itself, carrying both brushes, may be oscillated till the point of no sparking, which effect is found on the commutator. The armature core is a coil of No. 12 iron wire, measuring $17\frac{1}{2}$ inches diameter, 8 inches wide × $1\frac{3}{4}$ inch thick; on this core are wound 185 yards of cable consisting of 14 strand 16 B.W.G. in two layers and 59 sections. The outside of the core is set at $\frac{1}{4}$ths inch distance from the inside of the magnet poles, and when it rotates at a periphery speed of 2,300 feet per minute, an electromotive force of 110 volts and a current of 110 ampères is generated in the cable wound on it, being about 1 volt to each 1·85 yards wire, which taking the lowness of speed into account, is a very good result.

One of these machines, size $\frac{B}{4}$, is supplying current to eight 25 ampère arc lamps lighting the engine shed.

(To be continued.)

THE TELEGRAPH CONFERENCE.

AT the sitting of the Tariff Committee on Thursday, the 20th inst., the German proposals were again discussed in a modified form, but without any positive result. Afterwards, on the invitation of the Municipality of Berlin, all the delegates proceeded by rail to Babelsburg, whence they were conducted by carriage and steamer through the most attractive parts of the woods and lakes around Potsdam, and then landed at Potsdam, where another banquet with an accompaniment of fireworks awaited them.

On Friday the delegates visited the factories and workshops of Messrs. Siemens and Halske, as well as the newspaper and periodical department of the Post Office.

On Saturday, at a plenary meeting of the Conference, the resolutions of the Tariff Committee were discussed and approved in such a form as entitles one to say, according to the *Times* correspondent, that the proposals of the German Postmaster-General for the introduction of a reduced and uniform European tariff were adopted to about half their original scope and extent, but that is all. Of 25 delegates representing States, 21 voted in the affirmative, while four refrained from voting on the ground of want of instructions. England, Russia, France and Austria were among the ayes. Stated in brief and general terms, the result of the decision is simply this, that what is called the "Grundtaxe," or fixed primary charge on all telegrams, irrespective of the price per word, will be abolished, and that henceforth, therefore, the tabulated word tariff under the European Telegraph Convention will represent the real, as well as the apparent, price of messages. I say real, because hitherto the fixed Grundtaxe has always had to be added to the cost per word. Some States, however, Germany for example, reserve to themselves the option of imposing this Grundtaxe (so as not to lose on small messages), but yet in such a manner as shall not raise the cost of a telegram above the total amount of the simple word charge. Another important result of Saturday's resolution is that what is called the terminal tax, or share of charge on telegrams falling to the country of receipt, will be reduced and regulated—the large States receiving 10c. per word, smaller ditto 6¼c., and Russia, which insisted on a special arrangement in her favour, 30c. Germany had proposed 8c. and 4½c. for the larger and smaller States respectively. In like manner transit dues, or share of cost falling to countries through which a message merely passes, are to be fixed at 8c. for the large States, 4c. for the smaller ones, and 24c. for Russia. The general effect of these changes will be to reduce the present cost of certain European telegrams (apart, that is to say, from those between conterminous countries) by about 40 per cent., and it is calculated that the greater proportion of this falling off will probably have to be borne by the private companies, though it would be premature to make an estimate on this head until the details of the proposed innovation are settled. In addition to the above it is very probable that the cost of European messages to India, China, Japan, and Australia will be very considerably lowered.

The delegates to the Conference started on Monday on a visit to the Hanse cities, and in the evening were entertained at a banquet by the Senate of Bremen, in the famous Rathskeller of that free and ancient city. Perhaps the most sumptuous entertainment to which the delegates have hitherto been treated was a garden party given on Saturday evening in their honour by Herr Geheimrath (brother of the late Sir William) and Frau Siemens, at their residence in Charlottenburg. Their drawing rooms and lawns, which were all beautifully illuminated with the electric light, were crowded with about 300 of the chief social and scientific celebrities of the capital, and the hospitality offered them was worthy of such a German prince of science as the brother of Sir William Siemens.

THE ELECTROMOTIVE FORCE OF THE ELECTRIC ARC.

By VICTOR VON LANG.

THE resistance of galvanic elements, of which identical specimens are at hand, can, as is well known, be effected with the Wheatstone bridge by introducing an equal number of the elements in opposition to each other, and ascertaining the resistance of this combination in the ordinary manner. If the result found is divided by the number of the elements employed, the quotient shows the resistance of one of them.

Another method, which also requires an even number of identical elements, is as follows:—All the elements ($2\,n$) are introduced in series, and the circuit is closed by a suitable wire resistance. On this wire we seek out first the point, B, which has the same potential as the halving point, A, of the battery at the junction of the n and the $(n + 1)$ element. When this point, B, has been found, the resistance of the circuit between the points, A and B, can be determined with the Wheatstone bridge in the ordinary manner. As there are between A and B two at least approximately identical circuits, the resistance found, with due consideration of the connecting wires, will be half the resistance of half the battery. With an equal number of elements the immediate result of this method, as observed, is only the fourth part of that of the first method.

The search for the point, B, consists, naturally, in seeking in the connecting wire of the battery for a point which when connected with A gives no current. For this purpose the galvanometer of the Wheatstone bridge may be employed, but in this case it must not be inserted in the bridge. It is well known that in Wheatstone's original wire combination the measuring battery and the galvanometer can be exchanged, an arrangement which has been retained in the Siemens universal galvanometer.

The accompanying diagram (fig. 1) gives a view of the arrangement in the second manner. In an experiment made with the Siemens universal galvanometer and two small Daniell elements, I found by the first method 0·69 as the total resistance of these two elements. The two elements were then introduced in series, and closed by means of a short, thin wire. The second method then gave 0·17, which is, in fact, a fourth part of the former number.

Having thus proved the applicability of the second method, I resolved to use it for determining the counter electromotive force of the electric arc. Edlund, who discovered this phenomenon, long ago determined it by measuring the seeming resistance of the arc at different distances of the carbons. This is not like an ordinary resistance proportionate to the length, but is a linear function of it. The constant portion of this function can be viewed as a counter electromotive force.

Similar experiments were subsequently made with the aid of dynamos, first by Frolich and more recently by Peukert. The last measurements seem to have been executed very carefully, and gave a counter E.M.F. of 35 volts, a result which astonished Peukert, though it agrees very well with the result of my own measurements.

Though the foregoing renders the view of Edlund on the resistance of the electric light probable, it is rather an indirect confirmation. It seems not uninteresting to obtain, by the following experiment, a direct proof of the counter electromotive force of the

electric light. As to the real nature of the phenomenon it gives no information.

Fifty-eight Bunsen elements of a medium size were arranged in series and the circuit was closed as symmetrically as possible by two electric lights (L, L). Both the lights were arranged in series; the carbons used were of 5 mm. in diameter. Both carbons could be displaced on horizontal slides by means of screws, so that the luminous arc, the image of which was projected on the wall by means or a lens, could be easily regulated. The regulation of the one light was superintended by Prof. F. Exner, and that of the other by Dr. E. Lecher. The simultaneous burning of both lights was certainly a great difficulty, but after some trials it was found practicable to keep both lights in action simultaneously and in equal strength for a few seconds without hissing. The mutual distance was certainly only about $\frac{1}{3}$ mm.

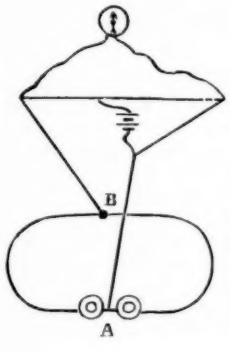


FIG. 1.

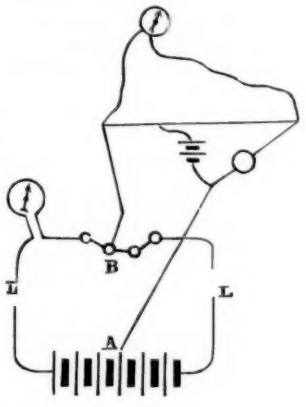


FIG. 2.

The Siemens universal galvanometer proved in this case far too sensitive. In its place was used a simple measuring-bridge with a straight platinum wire (92 cm. in length), using a Hipp's vertical telegraph galvanometer. As a measuring battery there served six large Smee elements, and, as comparative resistance, a coil of wire of four Siemens units.

Of the two points, A and B, the former, A, was placed at the connection of the 28th and the 29th element, the point B was at the end of a contact arm, which played over a series of 11 resistances of 0·1 Siemens unit. These resistances introduced symmetrically into the circuit of the battery were formed each of two spirals of copper wire 2 mm. in thickness, and became heated but slightly. They were sufficient for discovering the point, B, only when the two arcs did not burn too unequally.

Instead of each light, resistances could be introduced in order to have the same strength of current as when the carbons were luminous. For this purpose two resistance boxes were used, with coiled wires of about 1 mm. in thickness. These wires heated intensely, which, for the purpose in question, did not matter. If, however, it is desired to deduce from the subjoined measurements, not only the electromotive force of the arc, but also its almost vanishing resistance, the value of the resistances introduced must be accurately known.

For measuring the strength of the current a tangent-galvanometer was introduced into the main circuit, and could be thrown out by means of a lateral contact. Prof. F. Exner kindly undertook to read off this galvanometer, a difficult task, since the needle required a longer time to come to rest than the arcs could be kept constant. Unfortunately I had at my disposal no other ampèremeter giving more rapid indications. The woodcut (fig. 2) gives a view of the arrangement for the experiment.

The following twelve measurements were carried out with both arcs. The first column gives the successive number of the experiment, the second the strength of the current in ampères, and the third the observed resistance. From this resistance must be subtracted the resistance of the two conducting wires to the bridge, and the remainder must be multiplied by two to obtain the resistance of the half battery, *plus* that of one arc light and half the main circuit.

April 8th, 1885.

No. 2	7·21 Amp.	1·77 Ohms.
„ 3	4·27	1·62
„ 4	4·27	1·62
„ 5	4·49	1·85
„ 8	4·27	1·89
„ 9	4·14	1·70
„ 10	4·49	1·70
„ 11	8·21	1·70
„ 12	4·49	1·85
„ 13	3·46	1·77
„ 14	4·27	1·96
„ 15	4·27	2·15
Mean ...	4·33	1·82

In calculating this mean the observations 2, 11 and 13 were disregarded as being manifestly erroneous in the strength of the current.

Between these observations there were made others, where each of the arc lights was replaced by a resistance. Of course both resistances were selected equal, and their joint value is given in Siemens units in the following table of results. As it has been already said, these figures cannot serve for any further calculations on account of the heating of the wires.

No. 1	8 S.U.	3·73 Amp.	6·72 Ohms.
„ 6	6	5·11	5·66
„ 7	7	4·49	6·04
„ 16	7	4·65	6·04
„ 17	8	4·07	6·53
„ 18	8	4·06	7·02
„ 19	7	4·49	6·04
	Mean ...	4·37	6·29

If the means of both series of experiments for which the strength of the current is equal are compared, we see that the resistances observed differ by 4·47 ohm, or 8·94 for the two. So great, consequently, is the resistance compensated by the counter-electromotive force of one of the electric lights. To find this power we have merely to multiply this resistance by the strength of the current, giving an electromotive force of 39 volts.

I lay no particular weight upon the absolute magnitude of the last number. To that end the experiment must be repeated more than once, and with a stronger battery and extended to other bodies beside carbon.—*Repertorium der Physik.*

ELECTRIC LIGHTING IN LONDON.

THOUGH England has been said to be invariably behind the principal Continental countries and America in the adoption of that which is startlingly new, however useful, it can scarcely be asserted with truth that London, and more especially the City of London, has been so conservative of ancient ideas and customs as to allow even provincial towns to precede her in modes of obvious improvement. Rapid strides have been made of late years in the combination of beauty, in contradistinction to mere prettiness, with strength and stability in metropolitan architecture; for, notwithstanding that there have been several glaring failures in this respect, the fact remains that London of to-day is a vast improvement, from an architectural point of view—supposing, of course, that view not to

be of the purely fanciful order—upon the London of a hundred, or even fifty years ago. Seeing this fact, one would have expected that the very best means of illuminating the modern beauties of the City and its vast outgrowth would have been adopted as soon as it was discovered that there was a better than that in vogue. Yet whilst other towns are at least making attempts in this direction, and private prescience is manifesting itself in instances increasing in number every day, we see only the most insignificant efforts made in the Metropolis of the World to have its streets lit by the one effective means of illuminating during the dark hours of the night those features of interest which deservedly command so much attention whilst the light of day shines upon them. There is a social side to this question, for in many American towns the brilliant light has been found of rare virtue in suppressing evil-doing of many kinds; but it is not for us to deal largely with that aspect of the matter in these columns. Londoners in their corporate capacity are showing a sad lack of appreciation for the beautiful light placed at their disposal, and we can only ask, in conclusion, how long the blunders of the past are to prevent its adoption.

NOTES.

Electric Light for Photographing Gun Interiors.—Experiments were made, on Thursday the 20th inst., at the Royal Gun Factories in the Royal Arsenal, Woolwich, in order to test the application of a new electric lamp designed for making examinations and photographs of gun interiors. The system of scrutinising the bores of guns by means of electricity has only been a short time in vogue, and has proved of great value, but the want of a dynamo has prevented its general adoption at many places where it would have been of considerable use, and the authorities have now taken up readily a portable battery for the purpose of supplying the place of a dynamo in such cases. The battery, without being necessarily powerful, is chiefly serviceable on account of its constancy, as it can maintain a light of unerring brilliancy for a period of ten hours if requisite, and then enable the examiners to make their inspections with all the leisure they may desire. The experiment last week was to try the battery and a dynamo in competition. Two 8-inch guns were placed side by side in the new boring mills and photographs were taken of their interiors by both processes, the results, as far as could be judged by a cursory view, being equally satisfactory. Col. Tarleton, Royal Artillery, Assistant Superintendent of the Gun Factories, was present; the electric apparatus was directed by Mr. Angus, and Mr. C. O. Browne, of the Chemical Department, superintended the photography. In future it may be expected that reports of damaged guns sent in from distant stations will be accompanied by photographs, both internal and external.

A New Incandescent Lamp.—Mr. Max Muthel has patented in Germany an incandescent lamp requiring no vacuum. The filament used by him consists of a mixture of conductors and non-conductors of electricity. He takes magnesia, silicate of magnesia, &c., and porcelain clay, and forms a fine thread, which he heats to incandescence and saturates with a solution of platino-iridium salts, and afterward raises several times to incandescence, in order to reduce the absorbed salts to a metallic state. Mr Muthel supposes that the electric spark jumps, so to speak, from one particle to another, and in this way causes a heating of the other substances, which, brought to incandescence, emit a more intense light. In order to make the filaments stronger, they may be covered with chrome, the melting point of which is still higher than that of platinum.

The Electric Light in the Royal Navy.—Satisfactory trials of the electric light have taken place at Chatham on board the torpedo turret ship and ram *Conqueror*, which is one of the finest ironclads afloat, having cost half a million of money. The vessel is now in readiness for immediate service.

During the recent visit of the Lords of the Admiralty to Devonport Dockyard Lord George Hamilton and his colleagues inspected the *Conquest* corvette in the dry dock, where she is making good defects prior to leaving for the Pacific station. This vessel has been recently supplied with the electric light. Their lordships evinced considerable interest in the sloop *Mariner*, which will shortly leave for the East Indian station. She has been fitted with many of the latest improvements in the internal economy of a ship. Her guns are fired by electricity, and she is supplied with search and ordinary arc electric lights, the latter of which can be used ashore when the vessel is coaling. She is also fitted with incandescent lamps in every part, including the coal bunkers, where its utility will be easily understood after the serious coal explosion which not long ago occurred on board the *Inflexible* at Portsmouth.

A correspondent with the Mediterranean Squadron, in describing an attack that was made on the squadron by torpedo boats and steam pinnaces on the evening of the 7th inst., states that the boats were discovered by means of the electric search lights, and not one of them succeeded in getting near to the ships. The only good electric lights that were used were those on board the *Dolphin*. The *Temeraire's* are exceptionally bad, and it is hoped they will soon be replaced. Another correspondent, referring to the same incident, says that the boats never had a chance, for most of them being white were clearly visible under the brilliant electric lights about half a mile off.

At an entertainment given on board the torpedo ship *Vernon*, at Portsmouth, last week, the upper deck was beautifully lighted with electricity, and being covered in for the occasion, presented an extremely brilliant appearance.

Life of Incandescent Lamps.—It is stated that some of the Edison incandescent lamps in the Theatre Royal, Manchester, have been in constant use for over two and a-half years, which gives a life of over 5,000 hours.

The article which we publish on the lighting of Temesvar will give another very good idea of the lifetime of such lamps, and now, with improved manufacture, even better results may be looked for.

Electric Lighthouse.—Operations are in progress at the Island of May with the view of introducing the electric light into the lighthouse, a change which, it is believed, will prove a great boon to mariners. A large coal store is in course of construction, and the foundations of the engine house are being laid, concrete being used as a basis. It is expected two years will elapse before the whole of the improvements are in full working operation.

Accident in an Electric Light Tower.—The elevator in one of the electric light towers at Detroit broke its fastening and went up to the top in a very great hurry, striking so forcibly as to shatter the top of the tower. One of the lamps fell to the pavement within a few feet of a pedestrian, and a piece of iron weighing a pound or more bounded through one of the Post Office windows, knocking off the hat of a man who stood near by examining his mail. It was necessary to remove all the lamps, most of the fastenings being broken, but they were temporarily replaced during the day.

Electric Lighting in London.—It is stated that after the Vacation the library and hall of the Inner Temple will be made brilliant by the rays of the electric light.

Electric Lighting in Leeds, &c.—Messrs. Rishworth Bros., corn millers, York Street, Leeds, have introduced the incandescent electric light into their mill, and the whole place is now illuminated by this means. The installation consists of 97 16-C.P. Edison-Swan lamps, the current for which is supplied by one of Crompton's patent dynamo machines of the compound self-regulating type. The power is taken from the mill engine for the present by means of a belt. On each floor there is an ingenious arrangement in the shape of movable lanterns, provided for inspecting the interior of the various machines and gearing and for use in places where a naked light or even a covered oil lamp would be dangerous. The lights in the offices are provided with suitable Venetian shades. The work has been done by Mr. Wilson Hartnell.

Wentworth Castle, near Barnsley, the seat of Mr. T. Vernon Wentworth, is being fitted with the electric light by the same gentleman.

As an indication that something is being done in electric lighting in Yorkshire, it may be stated that no fewer than five of the leading firms in the trade are advertising in the Bradford and Leeds daily newspapers.

Electric Lighting in Peru.—A company, to operate under exclusive grants for 20 years from the Peruvian Government, has been formed to supply the electric light in Peru. During last month a plant of 90 arc lights was shipped to Peru from the Thomson-Houston Company's works at Lynn. Lima, the capital, will require 360 arc lamps.

Electric Lighting in Bleach Works.—The price of gas at Radcliffe, near Manchester, 4s. 3d. per thousand feet, considering that it is in the centre of a coal district, is held by residents and manufacturers of that town to be unnecessarily high, and this has been the cause of the introduction of the electric light in many works much earlier than would probably have otherwise been the case. Messrs. J. Whittaker & Co., of Mount Sion Bleach Works, Radcliffe, recently decided upon adopting the newer mode of lighting, and entrusted to the Manchester and District Edison Electric Light Company the electrical arrangements in connection with the installation, and this company, under the direction of the manager, Mr. Williamson, has satisfactorily carried out the necessary operations. Edison 16-C.P. incandescent lamps are used, and Mr. Whittaker asserts that he has more light with 200 of those than he had with the 350 gas jets which they have replaced. An Elwell-Parker dynamo, running at 1,100 revolutions per minute, is employed, power being ordinarily derived from a water wheel, but the gearing is so arranged that the machine may be driven by the works engine. Messrs. Whittaker & Co. estimate that they have better light, cooler rooms, and purer air, at one-fourth of the cost they were previously paying.

Consolidation of Electric Lighting Companies.—After a year's negotiations the three electric light companies of Boston, U.S.A., have determined upon combining their forces under the title of the Union Electric Light and Power Company of Boston. The companies were the Brush, the New England Weston and the Merchants'.

War Vessels and the Electric Light.—In the opinion of the *St. James's Gazette* it cannot be said that the practical experience of the electric light, as fitted to war ships, has been wholly satisfactory. It brightly illuminates everything upon which it is flashed, but it greatly intensifies the apparent darkness on both sides of the actual beam. Seamen, too, who are using the light become "night blind." Ordinarily their night sight is very good. They can at sea readily distinguish objects which to a landsman's gaze are invisible, but when electric lights have been flashing around them for a few minutes, this valuable gift temporarily deserts them. *St. James's* therefore suggests, as a minor naval need, that electric lights should be placed on outlying boats, and controlled by cables from shore, or from warships. In warlike operations an ironclad would be a great advantage if, while herself remaining in darkness, she could direct a beam whereby an opposing ship would be brilliantly shown up.

A Telephonic System of Fire Alarms.—With the object of preventing mistakes liable to occur with the ordinary apparatus, Supt. Walker, of the Philadelphia Electrical Department, has introduced a telephonic system which acts independently of the old method. It comprises 70 miles of wire connecting each fire-engine and truck house with the patrol stations, chief engineer's offices, and the electrical department. There are from three to seven engines in each of the 11 circuits, and the chief engineer can go to any box and communicate with any engine house and can order any particular engine or hook and ladder company to any locality. The tests made have been perfectly satisfactory. Telephone messages from the central station pass through the main office, but messages from the engine houses do not reach the central station until they have been received at headquarters. The system cost $1,900 less than the price asked by the Bell Company for instruments, and is expected to save thousands of dollars every year.

Sale of the Clay Company's Exchange.—To raise $333.35 for rent, the plant used in the exchange of the Clay Commercial Telephone Company at Philadelphia was sold about a month ago. It was stated that the company was in good financial condition, but in view of the uncertainty of the decision pending in the suit for infringement brought by the Bell Company, the directors were unwilling to put more money into the concern. The instruments and attachments sold, estimated by the superintendent at $10,000, realised only $50.

The Telephone at Northampton.—The exchange in connection with the system of the South of England Telephone Company at Northampton, which Mr. Henry C. Grahame has been labouring for the past three months to establish, was opened on Monday with 20 subscribers and four private lines. Mr. Grahame is sanguine that in a short time he will have Wellingborough and Kettering connected with Northampton, and a line from the last-named place to London. The Post Office had previously a dozen private lines in operation at Northampton, but no exchange. In view of this fact, there is every probability of a considerable increase in the number of subscribers to the new venture.

To a Correspondent.—No; ferrotype is not *Bell* metal, at least only in the telephonic sense.

Long Distance Telephony.—A correspondent at San Antonio, Texas, sends the following to a contemporary: "The South-western Division of the Erie Telephone Company, on August 1st, took control of probably the longest continuous telephone line operated by any one telephone company in the United States. Said line is 600 miles in length, reaches from Denison, through Dallas, Waco, Austin and San Antonio to Eagle Pass, on the Rio Grande frontier. Connecting with this main line are branches from various points, aggregating fully 1,000 miles additional pole line. No isolated lines (and they are numerous) are included in the above."

Telegraphists Drowned.—Two members of the Royal Engineers, engaged in the telegraph service, were drowned in Southampton water on Sunday evening. They and another man were in a small boat, and, in changing seats, it capsized. The civilian was saved.

Telegraph Revenue.—The receipts on the telegraph service for the period between April 1st and August 22nd amounted to £680,000, against £755,000 received between April 1st and August 23rd, 1884.

The Indian Telegraph Service.—Attention has recently been called to the treatment extended to those who have gone to India with pleasant visions of good remuneration and reasonably rapid promotion in the governmental telegraph service. The disappointments and hardships they have had to endure have been brought into prominent relief; and now "Justitia" writes to the *Times* complaining that the many memorials of the telegraph engineers submitted to the Secretary of State upwards of eight months ago have received no acknowledgment. In fact, he says, he is informed that neither the Viceroy nor his Council has so much as seen these appeals for help. The memorials were strongly supported by the Director-General of Telegraphs, and an admirable scheme of reorganisation was submitted by that officer. This scheme, with the several memorials, was pigeon-holed by the Government of India, pending a reply from the Secretary of State regarding certain proposals submitted last year for the amelioration of the grievances of the Public Works Department. Finding that these proposals were to be rejected, the Government ordered the Director-General to withdraw his scheme and to send in, in its stead, one drafted by themselves, which is totally inadequate and calculated to satisfy no one. This scheme has now been forwarded to the India Office for sanction, so that, unless some steps are taken at once to prevent its being accepted, a cruel injustice will be done to one of the most deserving bodies of officers that have ever served the Government. The writer concludes his lengthy epistle with the statement that the actual profits of the telegraph department as recorded in the administration reports for the last seven years, exclusive of compound interest, have amounted to 52½ lakhs of rupees. The combined office scheme (postal and telegraph) lately introduced is already paying 16 per cent. It is, therefore, not too much to expect that the Government of India should expend a portion of these profits in affording relief to those officers who have done so much to bring the service to its present state of efficiency.

New Postal Telegraph Office at Exeter.—Early in next month the new post office which has been built at Exeter to meet the increasing demands of the place will be open to the public. It is rather an imposing building, the front elevation being of Portland stone, relieved by a judicious amount of ornamentation. The public office is 42 feet by 32 feet, and is arranged so as to afford every convenience for the employés as well as the public. There is a counter 70 feet in length, and there are twelve message tables under the windows, where telegrams may be written. There is a separate office for the receipt of Sunday and night telegrams, which is reached by an open way from the street, being situate on the opposite side of the building. In the court at the rear, in a distinctly separate building, is the commodious battery room. It was found necessary to make this room of exceptionally large dimensions on account of the extraordinary number of messages which pass through Exeter to and from the West of England. The contractor is Mr. Bevan, of Plymouth, and Mr. H. Luff, who superintended the erection of the post offices at Oxford, Hereford, and Plymouth, is the clerk of the works.

Land Lines in Senegal.—The French Government are about to take vigorous steps in Senegal to complete the missing link (between Saldé and Bakam) in the telegraph line which unites the Upper Niger with St. Louis de Senegal. This portion of the line will be over 100 miles in length, and, when finished, the total length from St. Louis to Bamakar, on the Upper Niger, will be about 670 miles. The hostility of the natives in the district between Saldé and Matam has hitherto prevented the completion of this work, but it is now proposed to establish a military station to protect the work. Monsieur Hûbler, the Director of Telegraphs in the colony, is now in the interior making arrangements to carry this project into effect.

Proposed Telegraph Signal Station in Tory Island.—The belief is entertained by many that a telegraph signalling station on Tory Island, which is nine miles north-west of the mainland of Donegal, would prove most advantageous to the shipping interest of the country, as very early notice could be wired thence throughout the kingdom of incoming vessels by the North Channel. Tory is the first point made by vessels coming from America. Were a signal station established on it, the arrival of large steamers in home waters could be notified some five hours earlier than from Moville, and twelve hours sooner for the Clyde than from Kildonan. With the object of getting the Government to take up the matter a number of representative gentlemen in the North of Ireland have lately been drawing public attention to the subject in several ways. So as to have an authoritative deliverance on it, they, under the initiative of Mr. Jas. M'Neil, of Londonderry, resolved on having a meeting on the island itself. The meeting was largely attended, and Sir Robert M'Vicker, mayor of Londonderry, presided. Resolutions were unanimously adopted, setting forth the great importance, in the interests of humanity, commerce, and of the national safety, of having a telegraph signal station established on the island by the Government, and a committee was appointed to take charge of the matter.

Risks in Trans-Atlantic Telegraphy.—Mr. Richard A. Proctor, the popular lecturer on astronomical and other scientific subjects, writes to the *Times* as follows:—"Out of 15 transatlantic telegrams which I have had occasion to send, or to have sent me, during the last six years, three have miscarried. This is too large a proportion of failures, and the public ought to know how much or how little they can trust transatlantic telegraphy as at present conducted. Here are, in brief, the particulars of the three failures and of the compensation—save the mark!—made by the persons responsible. In the summer of 1879 I despatched from the office near Burlington House a telegram to my lecture agent in New York on important business, telling him to wire reply. No reply coming, I wired again, and was told no message had been received. For compensation I received expressions of regret and the price of the original message. Last June I wired from St. Joseph, Missouri, to my lecture agent here, in reply to a telegram of his on important business. Late in July I received a letter from him saying that the telegram referred to in my letters had not been received. I found it had got as far as London, but had not been forwarded. For compensation I received very courteous expressions of regret from the head Post Office, with suggestion that I should write to St. Joseph for return of the price paid for the telegram. On August 6th, at 11.30 a.m., I wired from Liverpool (office under North-Western Hotel) a message to St. Joseph, Missouri, in one word, but that word announced my safe arrival, and gave instructions on a business matter of importance to my wife. I have to-day received a letter from her, dated August 8th (not a mistake, for she mentions that guns were firing, &c., because it was the day of General Grant's funeral), from which I learn that my telegram, sent off at 5.30 a.m., St. Joseph time, on August 6th, had not been received at mid-day on August 8th. I do not yet know what compensation, if any, will be offered. Possibly the telegram may have been since delivered—on August 16th, for example, in which case no compensation need be expected."

West African Cable.—We learn that Captain E. de Vasconcellas is now in England representing the Portuguese Government at the Silvertown works during the construction of the Northern sections of the West African Cables, which will shortly be completed.

Cable Operations.—The cable ship *Monarch* arrived at Kirkwall on Friday, the 21st inst., to lay a cable to Stronsa, which will give more direct communication with Shetland.

Duplication of the South African Cable. — The Eastern Telegraph Company announces the laying of the duplicate cable between Zanzibar and Mozambique by the ss. *Seine*, belonging to the Telegraph Construction and Maintenance Company. The line has been laid with the view of improving the service, which has been such as to cause grave complaint, and to guard against future interruption of communication with South Africa.

Atlantic Cable Competition.—It appears that there have been ostensibly strenuous efforts made to end the present war waging between the parties owning Atlantic cables, and from the correspondence published in New York, and reproduced in London by the *Financial News*, it is difficult to say who commenced the negotiations, as each side asserts it was the other. The main point referred to in the correspondence was as to the possession of the Baltimore and Ohio land lines, which are held by the Mackay-Bennett combination, and which the Jay-Gould party is anxious to acquire. Mr. Garrett, representing the Mackay interests, in one apparently spirited letter, asserted that the Baltimore and Ohio lines were not for sale at any price; but this statement is not held to correctly represent the nature of the negotiations which have taken place, and which have been interrupted by a hitch of some sort. Those interested in cable matters should see the *Financial News* of August 27th.

The Kauffer-Goldner Battery.—It is stated that 2,432 candle hours were obtained in a recent trial test of this battery by the consumption of 4½ lbs. of zinc. Mr. Desmond G. Fitzgerald points out, however, in a contemporary, that even under theoretically perfect conditions, this consumption would represent but 5·13 horse-power hours. The time of burning was given as 152 hours, and the number of cells employed, nine; the E.M.F. would, therefore, probably be something under 18 volts. The two lamps used are said to have been of eight candle power each, but we rather fancy that this should be divided by two, if not more.

Carbon Filaments.—Dr. Puluj has made some very interesting experiments on the absolute firmness and density of the carbon filaments used in glow lamps. We do not remember having seen any description of tests of a like nature previously.

The Duty of a Professor.—We would recommend several of our prominent professors to peruse the article on p. 188 of our present issue. In our opinion, that which is therein quoted as the first duty of the professor is, in many cases, left to the last, a result probably due to the progress of civilisation.

The Accident at Earl's Court.—Since penning our comments on railway signalling, an inquiry has been opened into the circumstances attending the collision near Earl's Court Station, last Sunday. From this it appears that an electrical repeater is used to notify to the signalman whether the semaphore arms, when invisible, have or have not, performed their functions; but the man in charge of the signal station admitted in his evidence that *he did not in this instance look at the indicator*. The resident engineer, however, during his examination, showed that the repeater had not been affected, owing to non-contact on the signal post. From this, as has often been pointed out, it follows that improvements are still to be made in both mechanical and electrical methods of signalling, and that human agency is not always to be depended upon, whatever checking devices may be employed.

"Sairey Gamp" Redivivus.—An umbrella belonging to a passenger on the steamer *Princess Beatrice*, which runs between Larne and Stanraer, was discovered to be responsible for the peculiar conduct of the compass, which was so disturbed that the man at the wheel could not keep the vessel on her course.

A New Firm.—We learn that Mr. H. E. Harrison, B.Sc., A.M.I.C.E., has severed his connection with the Electrical Engineering College, Red Lion Square, of which he has been principal since its foundation, and has entered into partnership with Mr. F. C. Phillips, electrical engineer, of 2, Victoria Mansions, Westminster. The new firm will carry on the business of general and consulting electrical engineers under the style of Phillips and Harrison.

Contracts.—The magistrates and council of Glasgow (police) invite offers to renew and maintain the street firm alarms and A B C district system in connection with the fire department. Specifications and forms of tender may be had, and all information obtained, from Mr. William Paterson, inspector of fires, Chief Fire Station, College Street, with whom offers must be lodged not later than Wednesday, 2nd September, marked outside, "Tender for renewal of fire alarm systems."

Gallant Rescue.—We read in the daily press that on Saturday afternoon last a young child, whilst playing at the deep end of the ornamental water in St. James's Park, fell in, and soon after disappeared from sight. Although a number of men were near the spot, yet no one ventured to render assistance. A Postal Telegraph clerk, named William Berriff, shortly afterwards arrived on the scene, and on hearing the circumstances quietly put down his bag and dived into the water with all his clothes on. He succeeded in bringing the child to shore, and with some difficulty the apparently lifeless child was restored to animation. It is pleasant to record such deeds as these.

Garden Illuminations.—The electric lighting in the gardens of the Albert Palace, at Battersea, produces a very artistic effect. We should imagine, the grounds being of but limited extent, that a large arc lamp of say, 25,000 candle-power, placed on a high mast in the middle of the garden, would prove to be a considerable attraction, and we make the suggestion for what it is worth.

The Siphon Recorder.—Probably the best description of Sir William Thomson's siphon recorder is that written by Dr. A. Tobler in *Electrotechnischen Zeitschrift*. It is profusely illustrated, and has been reprinted in pamphlet form.

The Practical Telegraphist.—This is the title of a book which is to be ready by the 15th of September. The author is Mr. W. Lynd, A.S.T.E., and in addition to the latest technical information relating to telegraph engineering and electrical testing, the book will contain a comprehensive chapter on "Gravet's Calculating Slide Rule," adapted to electrical calculations. An article on this instrument appeared in the ELECTRICAL REVIEW about two years ago.

Electricity and Gas.—Those who have expressed their belief that the electric light will stimulate rather than discourage the manufacture of gas, will find a strong argument on their side in the recent returns, which show a very large increase for the past three years. Other uses than mere illumination have been found for gas, and where it is still used for the latter purpose, better light, and, consequently, a greater consumption of gas has been necessitated by the competition of the electric light. The fact seems to be overlooked by many, that the increasing use of the Otto gas engine for electric lighting purposes causes an increased consumption in that direction.

Blackpool Electric Tramway.—It is stated that the Blackpool Electric Tramway Company has decided to put in a claim against the Blackpool Corporation for the failure to complete the line of route according to undertaking.

The Underground Wire Commission in New York.—Commenting upon the query of the *New York Herald*, why the underground wire commissioners have permitted the wires to remain above ground so long, the New York *Electrical Review* remarks: "Perhaps these gentlemen realise the electrical and commercial problems to be dealt with in this work—a little matter that doesn't trouble the *Herald*—and are proceeding carefully and intelligently. To accomplish the work of burying all the various electric wires of this city so that their efficiency will remain undisturbed, and so that their life can be counted on as before, is a task of no small proportions, and we trust the honourable commissioners are considering the matter from a sensible and practical standpoint. No business man wants the wires put under ground if by it he loses his telephone or convenient telegraph office. No electrical company can afford to bury all its wires in the present stage of information on the subject, and those that are experimenting in this direction are continually encountering and overcoming obstacles that the talented writers of the daily press know very little about, and evidently do not care to be informed on, for that would destroy their thunder. The commissioners are acting wisely in hearing the views of the practical men in the field, and out of this will come some light on the vexed question of burying the wires." We trust there will.

Professor Forbes on "The Distribution of Electricity."—A correspondent of the New York *Electrician and Electrical Engineer* attacks Prof. Forbes's statement, made in his lectures on "The Distribution of Electricity," before the Society of Arts in February last (see REVIEW for Feb. 7th, 14th, and 21st), respecting the three-wire system, and says it is at variance with the results obtained by practical electricians at Chicago. He continues: "He (Prof. Forbes) makes the statement that that form of multiple series installation, known as the three-wire system, will give a saving in copper of only 25 per cent. They claim that despite the endorsement of Dr. Hopkinson, the professor is wrong, and the 'American financiers' are right, and base this assertion on the following: It is usual in America to figure electric light conductors as a certain per centage of the total resistance. The relation of the size of conductor to the current to be carried is a separate consideration, not affecting economy, except where the size of wire approaches the limit of safety—which only happens when circuits are quite short. Now, take the case of four lamps and one dynamo, each lamp having a resistance of 1 on the multiple system, our joint resistance will be $\frac{1}{4}$. If we put the same lamp in multiple series with two dynamos, the joint lamp resistance will be 1. We have here multiplied our lamp resistance by four, used the same lamps, and given them the same energy. Clearly, then, we can multiply the resistance of our mains by four and lose the same percentage of energy in the conductors. The third wire cuts no figure in the calculation, and its size is determined by the character of the service. Practically one-half the size of the + and − mains is ordinarily sufficient for the third wire."

Running Sewing Machines by Electricity.—A company is being formed in San Francisco to run sewing machines by electricity, on the Stockwell system. That city is said to offer a fine field for such an enterprise, and competent, energetic men have the matter in hand.

The Telegraph Ship "Monarch."—Captain Draper with Mr. Lumsden and staff aboard, is laying a new cable from Berwick Head and Tankerness to Stronsay. This new cable will do away with two cables, as formerly, and a large extent of land wire.

Electrical Railroads in Paris.—It is proposed to construct a small ærial railroad in Paris on the American model, the motive power being supplied by electricity.

The Effects of Overheating.—A telegram from Plymouth states that the new Promenade Pier, under the Hoe, which was opened last summer, was set on fire last week by the overheating of the electric lighting machinery, but the flames were soon extinguished, and no great damage was done.

Inventions for Disposal.—Amongst inventions advertised for disposal in last week's *Inventor's Mart*, are the following:—Electric fire alarm, auxiliary to the ordinary bell push, with which it does not interfere; automatic electric fire alarm, to give a vigorous alarm the moment the temperature rises above a pre-arranged limit; electric bell push, to give one, two, three, or more rings by a single push; electric signal, purely automatic, on the block system; small portable battery, to run medical lamp of two candle-power for 20 minutes, and again after an hour's rest; adjunct to battery, which keeps the zincs clean and free from hydrogen, and by this means keeping the E.M.F. more constant than is generally the case. "Any electrical invention" is "wanted." Particulars may be obtained of the Manager of our contemporary, 1, Queen Victoria Street, E.C.

Electric Signalling from Balloons.—Writing to *Invention* upon this subject, Mr. W. H. Le Fevre, President of the Balloon Society of Great Britain, states that in consequence of the number of applications made to him as to who is the original inventor of balloon signalling by electricity, he begs to state that the first invention was shown by Mr. Arthur Shippey, of Bayswater, at a garden party held at Lillie Bridge Grounds on September 10th, 1881; the patent for this was filed March 1st, 1881.

Lightning Fatalities.—During a severe thunderstorm last week near New Orleans, seven persons were killed by lightning, and five others injured. One bolt struck a tree under which six persons were standing, killing five and fatally injuring the sixth.

The Bentley-Knight Electric Railway.—Since August last year the East Cleveland, Ohio, Horse Railway Company has substituted electricity for horses as a motive power, and, notwithstanding most trying ordeals, exchanges say electricity has proved itself successful in every respect. The system employed has the usual stationary engines and dynamos, but the electric conductors are placed in a conduit which runs the entire length of the road between the rails. A conductor, depending from the car, passes through a slot in the conduit, and sliding in contact with the stationary conductors, maintains unbroken connection with the source of power. The cars ploughed their way easily through deep snow last winter. At no time, however deep the snow, was there any interruption of traffic, thus proving the reliability of electro-locomotion for this purpose. The conduit which contains and protects the electric conductors is kept perfectly clean by brooms attached to some of the cars, and thus snow and dust are swept into catchpits, located suitably with reference to street sewers. In a pamphlet just issued by the Bentley-Knight Electric Railway Company, whose system has been used in Cleveland, a comparative summary of the cost and maintenance of an electric, horse, and cable railway is given, as follows:—Estimate for newly constructed lines: Cost of horse road, $162,000; cost of electric road, $344,100; cost of cable road, $414,750. Annual expense of motive power for horse road, $102,960.00; electric road, $30,551.50; cable road, $75,590.00. Annual saving in cost of motive power: Electricity over horses, $72,408.50; electricity over cables, $45,038.50. These calculations are based on the equipping and operating of 40 cars over five miles of double track. They show the great economy of the electric tramway.

Electrical Catalogue.—Messrs. Cordner, Allen & Co.'s list of electrical apparatus, &c., is compact and comprehensive.

Electric Lighting in Italy.—The municipality of Vazallo has recently decided to illuminate the town by electricity, and the streets will be lighted with 70 Cruto incandescent lamps. The current will be furnished by two dynamos driven by a turbine, as abundant water power is at hand in the torrent Sesia. Besides the public lamps, the dynamos will supply from 90 to 100 lamps in private houses.

Change of Address.—Armand Levy, of 252, Goswell Road, has removed to more central premises, at 20, Chiswell Street.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

South Eastern (Brush) Electric Light and Power Company, Limited.—At an extraordinary general meeting of the members of this company, held at 68A, Cow Cross Street, E.C., on the 23rd ult., it was resolved to wind up voluntarily, and Mr. Wm. H. Pannell, of 38, Basinghall Street, was appointed liquidator. The resolution was confirmed on the 13th inst., and duly filed on the 21st inst.

Edison and Swan United Electric Light Company, Limited.—The annual return of this company, made up to the 14th inst., was filed on the 24th inst. The nominal capital is £1,000,000 in £5 shares. 17,141 shares are fully paid, and 89,261 are partly paid, £3 per share having been called upon the latter. The total paid up capital is £353,488.

Mechanical Telephone Company, Limited.—An agreement dated 31st ult., and filed on the 21st inst., regulates the purchase by this company from the Telephone Association, Limited, of the letters patent No. 9050, dated 17th June, 1884. The purchase consideration is £42,000, payable £21,000 in cash, and 4,400 fully paid £5 shares. Registered office, 75, Coleman Street.

Railway and Electric Appliances Company, Limited.—The annual return of this company, made up to the 11th inst., was filed on the 19th inst. The nominal capital is £500,000 in £1 shares. 130,201 shares have been issued, 78,500 being fully paid, and upon 51,701 shares 12s. 6d. per share has been called. Upon 50,553 the sum of £31,595 12s. 6d. has been paid, upon 1,148 shares £273 5s. has been paid, and £444 5s. remains unpaid. The amount paid upon 40,031 shares (cancelled by order of the Court) is £20,913 2s. 6d.

Bernstein Electric Lamp Company, Limited.—The registered offices of this company is at 9, Commercial Road, Pimlico.

DEFUNCT ELECTRICAL COMPANIES.

The following companies having failed to comply with the requirements of the law, have been struck off the register in accordance with the Companies Act, 1880:—

Improved Electric Telegraph Company, Limited.—Registered 20th May, 1875, with a capital of £200,000 in £10 shares, to work Barney's improved methods of transmitting messages. The last return, which was filed on the 4th October, 1878, shows that 1,907 shares were taken up and fully paid.

Belgian Thermo-Electric Generator Company, Limited.—Registered 20th February, 1875, with a capital of £50,000 in £5 shares, to work the patents granted to Mons. Charles Clamond by the Belgian Government for improvements in the construction of thermo-electric generators. The company has not filed a return, and the only shares issued are 125 subscribed for by the seven signatories to the memorandum and articles of association.

CITY NOTES, REPORTS, MEETINGS, &c.

The Lancashire and Cheshire Telephonic Exchange Company, Limited.

(From the "Manchester Guardian" of the 21st inst.)

THE fourth annual meeting of the proprietors of this company was held yesterday at the Memorial Hall, Albert Square, Manchester; Mr. Charles Moseley presiding.

The Chairman, in moving the adoption of the report and statement of accounts (an abstract of which has already been published), entered into an explanation of some of the items, and pointed out how in various directions the business of the company was being profitably extended. The position of the company since the last meeting had been materially altered by the terms of the new licence which had been obtained from the Post Office. Under the old arrangement they were restricted and hampered in every direction, but under the new terms the whole of those restrictions had been swept away and the company had absolute freedom to run their wires wherever they chose to go, to open call offices where and when they thought fit, and terms had been arranged with the Post Office for a very valuable service in connection with the transmission of telegrams to subscribers of the telephone system. These alterations in the position of the company had already had, and would have in the future, a very material influence on its development and the value of the concession which was held by the company. Dealing with the balance-sheet, the shareholders would see £15,986 put down for "salaries, general expenses, rents, rates, depreciation of furniture, interest, directors' remuneration, and other charges." Formerly those details were separately given, and it was on the advice of the auditors that they were thus grouped together. The amount was increased this year to the extent of £2,100, which had been paid as compensation for an accident which occurred at Oldham, and by which three men were fatally injured. The profit on the past year's working was £20,847, and after payment of the interim dividend in February last, a sum of £13,582 remained. Out of that sum the directors proposed to pay a dividend at the rate of 7 per cent., transfer £3,000 to a reserve fund, and carry the balance forward. The company were proceeding very rapidly with the extension of their system. During the current year they had expended £37,000 on capital account in the erection of wires and lines for their subscribers. Of that amount £25,000 had been spent in the erection of trunk wires under the new agreement with the Post Office, and they had put up 1,900 miles during the year, making a total mileage of 4,570 miles, and they had transmitted over the whole of the system no less than 10¼ million messages at an average cost of about one penny per message. Ninety call offices had been opened in the various towns of Lancashire and Cheshire, and they were now producing an annual revenue of £900 or thereabouts. During the year a domestic service had been introduced at the small rate of £12, for the convenience of their subscribers in order that the latter might have communications with their homes on reasonable terms, and this arrangement was much appreciated by the Manchester public. The engineers stated that the lines and the whole of the company's property were in a most satisfactory condition, and that, in spite of the increased work which had been done, there had been fewer breakages of wires in the past year than in any previous year. In various directions the company's operations were being extended, and by means of an arrangement with the Mersey Tunnel Company the subscribers in Birkenhead would in a short period be put into communication with Liverpool, and the exchange there would then be remunerative. The directors were also in negotiation with the Post Office authorities to allow them to place call offices in all of the post offices within the district. Some time must necessarily elapse before such a change was brought about, but they were not without hope that when the matter was fully laid before the Postmaster-General he would see the importance of giving that concession to the public, so that any person seeing a post office might know that it was a telephonic call office as well. Negotiations were likewise proceeding with a view to establishing call offices at the several railway stations. It would be in the recollection of the meeting that on July 9th, the directors received a deputation of subscribers on the question of rates. On behalf of the board he explained to the deputation the position of the company and replied to the statements that were brought forward as to the rates charged in other districts. Since then there had been sundry letters in the papers reiterating the questions that were asked on that occasion. It had been asserted that the charges in Dundee were extremely low and yet remunerative. He explained to the deputation why the remuneration of the telephonic system at Dundee was not to be compared with that of the Lancashire and Cheshire Company on account of the jerry way in which it was carried out, and the electrician, or some person who represented himself as such, wrote to the Manchester papers indignantly denying his statement. He (the

chairman) had authority for the statement that he made, that of the purchasers of the wires, the business having been transferred from the Dundee Telephonic Company to the National Company, and he thought they were perfectly competent to judge the value of the property which they had bought, and as he was informed by an authoritative official of the Company that the larger portion of the plant would have to be taken down and renewed, he thought that was a sufficient answer as to the stability and value of the exchange established by the Dundee Telephonic Company. The company was threatened, he noticed, with the opposition of the mechanical telephone. In the letters to the papers this was quoted as likely to form a very serious competition with the telephone system. For any man of common sense to attempt to prejudice the value of their telephone system by comparing a pillbox and string arrangement—(laughter)—such as the mechanical telephone was to the telephonic system now in use, seemed to him extremely childish. There was nothing new in the mechanical telephone. It was in the hands of the ancients centuries ago. The old Chinese knew about it. There was nothing new under the sun; certainly the mechanical telephone was not new; and as regarded its applicability to the purposes for which this company was formed, namely, intercommunication between subscriber and subscriber, it was absolutely useless. It might take the place of speaking tubes and arrangements of that kind, although in his opinion the speaking tube was a much better means of communication. It was, however, impossible that it could in any way affect the value of their property or the development of their business. (Cheers.) The directors had before them a new arrangement with the parent company with reference to royalties, which undoubtedly would in the very near future form a very important feature in carrying on their business. Up to the present time they had paid the United Company a royalty per instrument, and as they had to pay this in all cases, even where the offices were adjacent to each other, the royalties became a very important consideration, but by the new arrangement, he believed, they would in a short period be able to put before the public a tariff of charges for internal communication of that kind which neither mechanical telephones nor anything else would be able to compete with. (Cheers.) He might mention also that the directors had under consideration a scheme whereby two or three persons might be subscribers to one wire, and share the cost between them. The company had been assailed on all sides. Their stability was questioned, and doubts arose in the minds of some shareholders as to the actual value of the property. It was not an easy thing for the directors to prove that they had a tangible position and an unassailable one so far as they were competent to judge. Within the last few weeks there had been an important infringement case tried in London, and the position of telephone companies had been materially strengthened by the decision of Mr. Justice North, who clearly laid down the law by which this company held its rights and privileges. As far as the directors could judge, having before them all the points which had been raised in respect to infringements, there was not much probability that during the time over which the company possessed the sole right of using telephones there would be any competition, and as they had until the year 1892—not 1890, as was stated by some of the correspondents—to develope their business and to lay their hands upon the ground which they covered, they were strongly of opinion that at the expiration of that period they would be absolutely unassailable from any quarter or under any circumstances. (Hear, hear.)

Mr. W. Agnew, M.P., seconded the motion, remarking that to his mind the position of the company was eminently satisfactory. He took occasion at the same time to eulogise the chairman for his able and assiduous attention to the interests of the undertaking, and to express his full confidence in the company's future success. As long as the interests of the public were considered as well as those of the subscribers he had no fear for the result. He was, he added, one of the largest shareholders in the concern, and he had no intention of disposing of any of his shares. In his opinion the property had been unfairly attacked, and he could not help thinking that some members of the Stock Exchange were not particularly friendly to it. The system which obtained of bearing down property which is not your own he never could regard, although not particularly thin-skinned, as a moral system of doing business. (Hear, hear.)

The resolution was carried unanimously, as was a subsequent one declaring a dividend at the rate of 7 per cent. per annum less income tax.

Messrs. F. W. Reynolds, G. H. Robertson (Liverpool), and J. Thompson (Manchester) were re-elected directors, and Mr. C. E. Trevor was again chosen to be one of the auditors of the company.

It was further resolved, at the extraordinary general meeting held at the conclusion of the ordinary business, "That (subject to the consent of the United Telephone Company, Limited, being obtained) the capital of the company be increased by the issue of 100,000 new shares of £1 each, to rank *pari passu*, and to be on a similar footing in all respects with the shares of the original capital (except as regards dividend, which is to accrue proportionately as the shares are paid up), and that such new shares be offered to the members of the company, in one or more lots, in the proportion mentioned in clause 43 of the articles of association, at such premium (if any) and payable by such instalments, as to the directors may from time to time appear expedient." These new shares will, it was intimated, be issued at par to the shareholders.

A vote of thanks was passed to the Chairman and his colleagues for their services, and the meeting terminated.

NEW PATENTS—1885.

9817. "Incandescence electric lamps for burning under water." F. WYNNE. Dated August 19.

9827. "Electric bells." P. JOLIN, T. BALLARD. Dated August 19.

9833. "Galvano-electric medical belt or band." A. CHADWICK. Dated August 19.

9845. "Arc lamps applicable to other purposes." C. E. L. BROWN. Dated August 19.

9896. "Galvanic element or battery." H. J. HADDAN. (Communicated by K. Pollak and G. Wehr.) Dated August 20.

9903. "Electric targets." G. ARNOULT. Dated August 20.

9908. "Dynamo-electric machines." F. H. ROYCE. Dated August 21.

9924. "Manufacture of electrical conductors." E. FOX. Dated August 21.

9962. "Telephones." A. M. ROSEBRUGH. Dated August 22.

10011. "Compound galvanic batteries and method of working the same." S. H. EMMENS. Dated August 24.

10031. "Telephonic communications." H. WESTMAN. Dated August 25.

10065. "Thermo-electric batteries." H. E. NEWTON. (Communicated by H. W. Cook.) Dated August 25.

10074. "Telephone toll system." J. Y. JOHNSON. (Communicated by H. Edmunds and C. T. Howard.) Dated August 25.

10075. "Electrical lamp." V. KLAN, F. SPURNY. Dated August 25.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1884.

11542. "Improvements in dynamo-electric machines." S. WILLIAMS. Dated August 22. 4d. Relates to improvements upon the apparatus described in letters patent No. 314, of 1884.

11709. "Electric clock." T. CALLIPHRONAS. Dated August 27. 6d. The principal feature of this improved clock is its driving mechanism, similar in its arrangement to what is known as a gravity escapement. In it there is an oscillating armature moving between two electro-magnets. This armature is entirely independent of the pendulum properly so called. The oscillating armature carries two pins or bars, which lift gravity pallets. The gravity pallets are substantially of the usual construction, and carry contact pieces, the position whereof may be adjustable with relation to the pendulum proper, which latter is of substantially the same construction as those of ordinary clocks, but has two suitable contact pieces opposite to those on the gravity pallets. The oscillating armature and the pendulum move in opposite direction. The pendulum maintains its movement by reason of the effect of the gravity pallets. The gravity pallets not only serve to actuate the pendulum, but also complete or interrupt one of two circuits which lead to the source of electricity for driving the clock. The oscillating armature (which is a permanent magnet) serves alternately to raise the two pallets and to allow the armature to acquire a certain momentum before it touches the pallets. The motion of the latter is limited by banking pins or stops.

11843. "Improvements in the method of working telephonic exchanges and in apparatus connected therewith." L. J. CROSSLEY, J. F. HARRISON and W. EMMOTT. Dated September 1. 6d. The inventors connect a telephone on the earth side of each switch board, to which the operator attends, and the subscriber, in place of ringing up the central exchange, simply calls out the number required, which the operator hears and immediately supplies. Heretofore this has been accomplished at the cost of two wires into the subscribers office. The inventors avoid this by connecting a suitable indicator capable of recording one, or, better still, two signals from the subscriber, from which, it will be seen that the subscriber can call up his correspondent as often as required after the exchange has put him through, without effecting the exchange, while, on the other hand, he can, if desired, call up the exchange to advise him that he requires another communication, or for any other purpose.

12026. "Improved self-working electrical clock." J. G. KNIGHT. Dated September 5. 6d. The first vibration of the pendulum carries a crutch from the electromagnet, falling again by its own gravity, and causes the click to take one tooth of a ratchet forward, making contact by the action of the click with the contact springs, causing the attraction of the armature towards the coils or electro-magnet, impelling the pendulum forward at the same instant. The arrangement also causes the alternate use of two batteries every 24 hours.

12350. "Improvements in secondary batteries or accumulators." D. G. FITZ GERALD. Dated September 12. 4d. The object of the invention is to greatly diminish the time requisite

to "form" the plates in the secondary battery of the "Planté" type, and to allow of the substitution in other forms of accumulator of a simple plate of lead in lieu of anodes of more complicated structure. The invention consists in the employment, as the electrolyte in charging the secondary battery, of a solution of sulphate of magnesia, alone or in conjunction with other salts. As the solution of sulphate of magnesia becomes acid by the effect of electrolysis, there is added from time to time magnesia, or the carbonate of this earth, to the solution in order to neutralise the sulphuric acid liberated. This charging solution may, when the secondary battery is discharged, be replaced by a solution of higher conductivity, such as dilute sulphuric acid.

12517. "Improvements in galvanic batteries and in carbons for the same." P. R. DE FAUCHEUX D'HUMY. Dated September 17. 6d. The inventor employs outer cases of wrought or cast iron or steel of very extended interior surface—that is to say, grooved. The carbons are of the same form as the metal cases. The first forms the exterior receiver, and contains pure water, or water mixed with chemical composition. To dispense with porous vases the inventor employs hollow carbons, which are of similar form to that of the external metal case, but grooved if necessary on both its exterior and interior surfaces, in order to increase the surface as much as possible. This carbon serves as a receiver, and contains the depolarising liquid; it is plunged directly into the metal case, and a terminal attached to this carbon forms the second pole.

12547. "Improvements in electric bells." A. MYALL. (Communicated from abroad by Messieurs E. Recordon et Compagnie, of Geneva.) Dated September 18. 6d. The improved electric bell has the smallest possible size and very elegant form. All the parts are fastened on one metal plate, the employment of wood being carefully avoided, so that the dampness of walls or change of temperature cannot have any bad effect upon the mechanism, as is the case with electric bells of ordinary construction. The cost of manufacture can be reduced to a minimum, on account of the simplicity of the mechanism, and also because the expensive wood or sheet-metal box covering the mechanism is wholly dispensed with, and the bell itself substituted for such wooden or metal box.

12626. "Improvements in electric arc lamps." A. PFANNKUCHE. Dated September 20. 6d. The inventor uses a compound or double clutch, capable of gripping the rod of the carbon holder, or it may be the carbon only, to lift it when the arc is to be struck, and also to pull it downward or forward when the length of the arc requires to be adjusted in consequence of the burning away of the carbon. This clutch is composed of two halves or parts, each provided with a knife edge to press against the rod or carbon. These two parts are set, one above the other, on opposite sides of the rod, and are jointed or hinged together by short connecting pieces. To each of the free ends of this clutch a soft iron armature is fixed. One of these armatures is set beneath the poles of an electro-magnet in the main circuit, and the other is set over the poles of an electro-magnet in a shunt circuit. This is according to one arrangement of the parts; but it is obvious that other arrangements of the parts may be adapted. When the current is put on, the main electro-magnet attracts its armature, and the clutch is lifted with the rod or carbon, which it grips, and the arc is struck. As the carbons burn away, and the resistance of the arc becomes greater, the pull of the shunt electro-magnet upon its armature increases till it draws the armature down, and with it the clutch, and the rod or carbon which it grips.

12725. "Process for electrolytic extraction of copper from its ores." E. MARCHESE. Dated September 23. 4d. The inventor smelts a portion of the ore that is to be treated into the condition of a matt or regulus, consisting generally of copper, iron and sulphur, which he casts in the form of plates, to be employed as the anodes in the electrolytic baths, plates of copper being used in them as the cathodes. Another portion of the ore is treated to obtain solution of sulphate of copper. For this purpose the ore is roasted and lixiviated, sulphuric acid being added to dissolve out the oxides. The resulting liquid, which is mostly sulphate of copper with sulphate of iron, is charged into the electrolytic baths, where it is decomposed under the influence of the electric current. Metallic copper is deposited on the cathodes, and the sulphides of the anodes are dissolved producing sulphuric acid and iron sulphates, so that none of the iron is deposited on the cathodes.

13922. "Galvano-electric generator." J. IMRAY. (Communicated from abroad by P. Jablochkoff, of France.) Dated October 21. 6d. Relates to a sodium battery.

13941. "Improvements in electric motors." W. R. LAKE. (Communicated from abroad by J. B. Atwater, of Chicago.) Dated October 21. 6d. Relates to electric motors and comprises improvements in the rotary electric motors described in the specification of United States patent, number 278,760.

14601. "Improvements in dynamo-electric machines for plating and depositing metals." G. F. CHUTTER. Dated November 5. 4d. Applies principally to dynamo-electric machines having the magnetic axis of their armature magnets at right angles to or on radial lines from the axis of the shaft of such armature, each separate and opposite or adjacent arm of such magnets being connected magnetically through the shaft.

16910. "Improvements in the distribution of electricity." S. PITT. (Communicated from abroad by T. B E. Turretini, of Geneva.) Dated December 24. 10d. Consists in introducing into the circuit of a dynamo machine constructed for high tensions, groups of accumulators, of which the number will vary according to the fall of potential, which it is wished to utilise at a given point, and to lead a current to each pole of each group of accumulators, so that all the lamps or electro motors placed upon the derived circuit going from one pole to the other, to one of the groups, shall be subjected only to the difference of electromotive power corresponding to the groups of accumulators on which they depend.

1885.

2509. "Improvements in electric clocks." H. ARON. Dated February 24. 6d. Consists in the arrangement of an electro-magnet in combination with an armature connected to a lever arm, the movements of which serve to give a regular impulse to the pendulum of the clock, as well as to impart motion to the dial train, and also to close and interrupt, at the exact period required, the circuit within which the electro-magnet is enclosed, thus causing the armature to be attracted and released in regular adjustable intervals.

2572. "Improvements in electric meters." J. E. H. GORDON. Dated February 25. 6d. Relates to improvements in the meter described in patent No. 2922, of the year 1883.

3037. "Improvements in telephonic transmitting instruments." S. P. THOMPSON and P. JOLIN. Dated March 7. 4d. Relates to telephonic transmitters in which, instead of a diaphragm, tympanum, reed, tongue, or other like vibrating piece fixed at one or more points, the inventors use a piece which they term a valve, which is free to move, as a whole, under the influence of the sound waves, without deformation or change of shape.

3109. "Improvements in electric conductors." A. C. TICHENOR. Dated March 10. 4d. Consists in encasing or enclosing a wire or metallic strip of any required length or size, surrounded or enveloped by a core or body of powdered or pulverised carbon, in a tubular or other equivalent formed case or cover composed of one or more layers or wrappings made of any substance or material possessing suitable strength and flexibility, and covered or coated with some protective insulating compound substance or material.

3261. "Construction of voltaic batteries." A. KHOTINSKY. Dated March 12. 4d. Relates to an improved construction of the secondary batteries described in patent No. 5540 of 1883.

3616. "Application of the electrical light to gymnastic appurtenances." J. HARRISON. Dated March 20. 4d. This invention has for its object the application of the electrical light to gymnastic appurtenances, more especially to Indian clubs for stage or other effects.

3678. "Improvements in voltaic elements." C. P. ORNE. Dated March 21. 4d. This element consists, like various others, of a jar or reservoir of any proper material for holding an acid solution, and within such solution is a plate or stick of carbon and a porous cell, the latter in the present instance containing quicksilver and a stick or piece of zinc immersed therein. Fig. 1 represents the element as complete, while fig. 2 shows a vertical section of my improved form of electrode embodying the invention. A represents the element as an entirety, B the vessel for containing

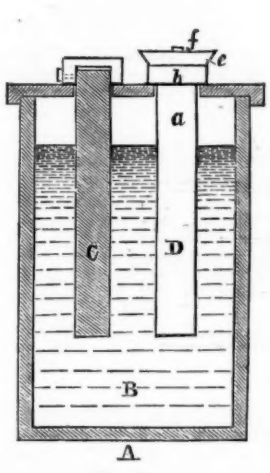


FIG. 1.

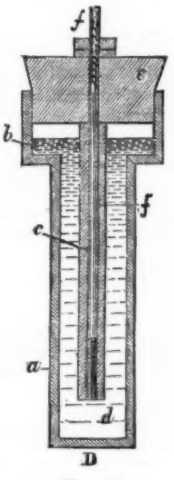


FIG. 2.

the acid solution, c the carbon or positive electrode, and D the negative electrode. The latter is compound, so to speak; that is, it consists of a porous cup, E, which is preferably cylindrical in shape, the lower cylinder, *a*, being surmounted by and forming part of a second cylinder, *b*, of larger diameter; *c* is a stick of zinc, which is shown as provided with a hole, *d*, passing through it longitudinally. Within the upper part, *b*, of the cup, E, is disposed a tightly fitting stopple, *e*, through which is passed a metallic rod, F. This rod extends into the amalgam passing through the bore, *d*, which is a loose fit therefor, and consequently the zinc is free to move thereupon whenever circumstances may require.

3991. "Improvements in automatic switches for use in charging secondary batteries or accumulators." T. J. JONES and R. BELFIELD. Dated March 28. 6d. The switch consists, essentially, in the combination of an electro-magnet or magnets or a solenoid, a permanent magnet attached to one or more rocking frames carrying contact arms, mercurial or other contacts, and a resistance, so connected and arranged as to cause the battery to be switched out of, and the resistance to be switched into, the circuit of the dynamo and *vice versâ*, without breaking the current, and also to rectify the direction of the charging current in case of reversal of polarity of the source as above mentioned.

4120. "Improvements in dynamo-electric machines." G. FORBES. Dated April 1. 4d. Consists in a new method of arranging the parts whereby a great saving in copper wire and in iron is effected, and less energy is required to magnetise the machine. To effect this the inventor fixes a coil or coils of wire round the revolving part (which part may be identical with or equivalent to the revolving part of any of the well-known types as mentioned above). These coils, when traversed by an electric current, serve to magnetise the revolving part, and they enclose it completely except where the poles of the field magnets are found in the usual types. The whole of the revolving coils and of the fixed coils is enclosed as close as is convenient with iron.

4130. "Improvements in apparatus for intensifying electrical currents." F. P. E. DE LALANDE. Dated April 1. 6d. The object of the present invention is the construction of a system of apparatus by means of which currents of small electromotive force generated by any given source of electricity, such as a battery composed of a few cells only, are transformed into currents of a high electromotive force, having this peculiarity, that the high tension currents so obtained are possessed of the property of operating through great resistances not only on polarised receivers (that is to say receivers in which there are permanent magnets), but also on ordinary receivers, electro-magnets, relays, electric bells, &c.

4534. "Improvements in automatic safety devices for use with electric currents." R. P. SELLON. Dated April 13. 4d. Fig. 1 is an end elevation, fig. 2 is a side elevation, and fig. 3 a plan of the apparatus. The inventor mounts upon a base of any convenient material a bobbin, *a*, of suitable substance, on which he winds a convenient quantity of conducting wire; in this bobbin, *a*, he inserts a soft iron core, *b*, capable of longitudinal movement within the hollow bobbin, *a*, the movement of the core being adjustable at will, and the position of the core within the bobbin or electro-magnet being registered on a dial, *c*, in any convenient way. Preferably at right angles to the core, *b*, and at the opposite end to that at which the indicating dial is placed, he places an armature, *d*, pivotted or suspended above the bobbin, *a*, upon an arm, *e*, carried from the opposite end of the core to which the armature itself is in proximity; this arm, *e*, he prefers to make of soft iron, so that, when a current traverses the wire wound upon

FIG.1.

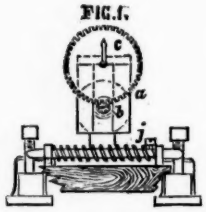


FIG.2.

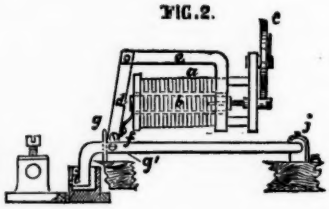
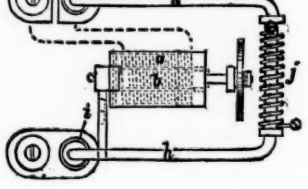


FIG.3.



the bobbin, it causes the core to develop a certain magnetic polarity, while the armature, *d*, being magnetically connected to the core and arm to which it is pivotted, becomes the opposite pole of the electro-magnet and developes an opposite polarity to that portion of the core to which it is in close contiguity. Thus, upon a current passing through the coils of the electro-magnet the armature is attracted towards the core, this attraction being dependent on the current in circuit and upon the distance apart of the core and armature, this distance being adjustable and indicated upon the dial or scale provided for that purpose. To prevent the armature, *d*, coming into contact with and sticking to the core, *b*, he employs a spring, *f*, shown in fig. 2, which allows the armature sufficient range of movement to disengage the pins, *g*, g^1, hereinafter mentioned. Supposing the dial, *c*, or scale to be graduated to the various strengths of current and various distances through which the core will attract the armature against it, it will be obvious that this electro-magnet may be adjusted to operate with any desired current, within the limits indicated on the dial, *c*, or scale. To the lower end of the armature, *d*, he attaches a pin or stop, *g*, corresponding to a second pin or stop, g^1, attached to a conducting strip of metal, *h*, the two free ends of which dip into mercury cups, *i*, i^1, through which the current passes into the circuits. One of these mercury cups corresponds to one terminal of the electro-magnetic safety device, the current passing thus from one terminal into such mercury cup, then through the conducting strip, *h*, before mentioned, into the second mercury cup, and finally through the coils of the electro-magnet to the opposite terminal of the device. This conducting strip, *h*, tends to be forced upward, so that its ends leave the mercury cups by means of a spring, *j*, suitably attached thereto; but it is normally held down by the pin, *g*, attached to the armature, *d*, of the electro-magnet, impinging upon the pin, g^1, attached to the conducting strip, *h*, and thus preventing the spring, *j*, before mentioned, coming into action, until such time as an excess of current, beyond the amount desired, passing through the coils of the electro-magnet, causes the core, *b*, to attract the suspended armature, *d*, when the pin, *g*, attached to the armature, *d*, will move off the pin, g^1, attached to the conducting strip; thus allowing the latter to be impelled out of the mercury cups by the action of the spring, *j*, and so breaking the circuit.

CORRESPONDENCE.

Inductional Transformers.

Referring to Mr. Esson's remarks made at a meeting of the Society of Engineers in April last about transformers for alternate currents with closed magnetic circuit, I may state that the first actual experiments with such a transformer were made at Messrs. Ganz and Co.'s works as early as August 7th, 1884, and that the Austrian patent was filed March last.

O. T. Blathy.

Induction or Leakage.

If you will permit me a little space in your next issue I would point out the theory, which I entertain, of the operation of an earth wire in an "auto induction cable."

The law of "inverse squares" points to an equal amount of induced current in each of the adjacent conductors (which are usually twisted round and round with a view of keeping them tolerably equidistant), but I think that Mr. Sandy has overlooked the facts that the current would be stronger in the case of the earth wire, inasmuch as these wires are usually of a thicker gauge, and therefore higher conductors than the ordinary lines; moreover, they being connected directly with the earth, avoid the large resistances which the instruments at each end of the lines present. From this I deduce that the earth wire performs to an extent the function of a return wire, though, of course, in a less degree. In conclusion, I would add that I have always noticed in cases where there have been several wires running parallel and one has run to a distance much in excess of the others, that that wire has been the least disturbed.

Apologising for the encroachment on your columns.

Arthur Edgar Cotterell.

August 24th.

Telephone Companies' Addresses.

Will you kindly let me know through your correspondence column in your next issue the addresses of the "South of England" and the "West of England and South Wales" Telephone Companies, if they are two distinct affairs, and if not, the principal address of the firm and oblige.

A. Williamson.

August 24th, 1885.

[The first is 98, Cannon Street, London; the second, 16, High Street, Bristol. They are distinct affairs, we think.—EDS. ELEC. REV.]